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Subscriptions should be sent to the Superintendent of Documents, United States Government Printing Office, Washington 25 D. C.

Yearly subscription \$5.25; foreign subscription, \$6.00.

Single number, 45 cents.

Exchange of publications may be extended to medical and scientific organizations, societies, and journals. Communications on this subject should be addressed to the Editor, UNITED STATES ARMY MEDICAL JOURNAL, Potomac Annex, Department of the Navy, Washington 25, D. C.

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##### ***Current List of Medical Literature***

(Army Medical Library) Monthly listing of journal contents, subject and author index monthly, cumulative index annually.

##### ***Quarterly Cumulative Index Medicus***

(American Medical Association) Author and subject.

VOL. III

JANUARY 1952

NO. I

# UNITED STATES ARMED FORCES MEDICAL JOURNAL

*Published Monthly by the Armed Forces Medical Publication Agency, Department of Defense*



WAYNE G. BRANDSTADT, Colonel, M.C., U.S.A., Editor-in-Chief  
ROBERT J. BENFORD, Colonel, U.S.A.F. (MC), Associate Editor  
WILLIAM R. WHITEFORD, Captain, M.C., U.S.N., Associate Editor

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THE PRINTING OF THIS PUBLICATION HAS BEEN APPROVED BY  
THE DIRECTOR OF THE BUREAU OF THE BUDGET, OCT. 19, 1949

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UNITED STATES  
GOVERNMENT PRINTING OFFICE  
WASHINGTON : 1952

For sale by the Superintendent of Documents, U. S. Government Printing Office  
Washington 25, D. C.

# Foreword

The UNITED STATES ARMED FORCES MEDICAL JOURNAL represents the unification of the BULLETIN OF THE UNITED STATES ARMY MEDICAL DEPARTMENT and the UNITED STATES NAVAL MEDICAL BULLETIN. This joint periodical is the medium for disseminating information of administrative and professional interest to all medical personnel of the Department of Defense.

The Chairman of the Armed Forces Medical Policy Council and the Surgeons General of the several services invite all medical officers, dental officers, Medical Service Corps officers, Nurse Corps officers, and officers of the Veterinary Corps of the Armed Forces, and the medical consultants of the Army, Navy, and Air Force to submit manuscripts for publication in this JOURNAL.

W RANDOLPH LOVELACE, II, M.D.,  
*Chairman, Armed Forces  
Medical Policy Council,  
Department of Defense*

GEORGE E. ARMSTRONG,  
*Major General, U.S.A.,  
Surgeon General, U.S. Army*

LAMONT PLUM,  
*Rear Admiral, MC, U.S.N.,  
Surgeon General, U.S. Navy.*

HARRY G. ARMSTRONG,  
*Major General, U.S.A.F.,  
Surgeon General, U.S. Air Force.*

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OFFICE OF THE SECRETARY OF DEFENSE  
ARMED FORCES MEDICAL POLICY COUNCIL  
WASHINGTON 25 D.C.

MEMORANDUM FOR: Personnel of the Medical Services of the  
United States Armed Forces

The Armed Forces Medical Policy Council, which was established on 2 January 1951, held its twenty-second and last meeting of the year on 17 December. It has been my pleasure to serve first as a member of the Council under the chairmanship of Dr. Richard L. Melling, and second, as Chairman of the Council since 1 July.

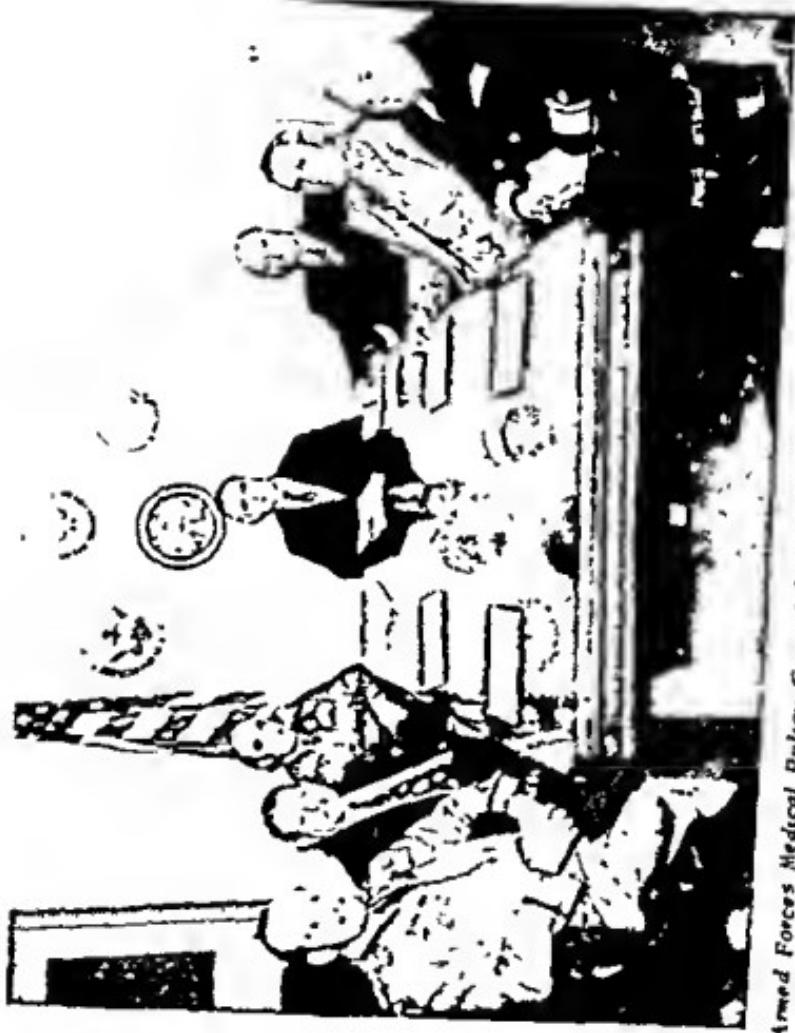
In reporting some of the accomplishments of the Council during the past year, there are the standardization of medical recording and reporting procedures, the establishment of the Armed Forces Hospital Expansion Planning Program, the approval of preliminary drawings of standard plans for permanent and nonpermanent Armed Forces hospitals, the adoption of the principle of built-in clinics rather than the conventional outpatient department, the adoption of the back pressure arm-lift (Holger Nielsen) method of artificial respiration, coordination of research in the medical and health fields with the Research and Development Board, the Armed Forces Blood Donor Program, point credits for reserve officers attending the section on Military Medicine of the American Medical Association, and many others. None of these accomplishments could have been achieved without complete cooperation of the military medical services, the three military departments, and of the Office of the Secretary of Defense.

Many of the suggestions sent in to the Council from members of the military services overseas and in the Zone of Interior have been most helpful.

It is my sincere desire and belief that during this year the Council will develop programs and policies which will further assist the medical services of the three military departments in the accomplishment of their mission.

*W. Randolph Lovelace, II*

W. Randolph Lovelace, II, M. D.  
Chairman  
Armed Forces Medical Policy Council



*Armed Forces Medical Policy Council (Left to Right): Maj. General Harry G. Armstrong, General George E. Armstrong, The Surgeon General, U. S. Air Force, Dr. Isidor S Ravidin, Maj. Gen. H. Chairman, Dr. Alfred S Shands, Jr., Dr James P. Hollers, and Rear Admiral Herbert L. Pugh, MC, U. S. N., The Surgeon General, U. S. Navy.*

# Neurosurgery in World War II

Winchell M. Craig, *Rear Admiral, MC, U. S. N. R.* (1)

THE specialty of neurosurgery in the Medical Corps of the United States Navy was recognized before the beginning of World War II by the Bureau of Medicine and Surgery. The medical specialist units, of which there were 110, were made up of reserve officers who were medical and surgical specialists. On 7 December 1941, the first medical specialist unit, designated as Neurosurgical Unit Number 54, was activated, and when war was declared it was sent to the U. S. Naval Hospital, Corona, Calif. This unit included 3 neurosurgeons in addition to the other members. From that time, neurosurgery in the Medical Corps of the Navy was established, and accredited neurosurgeons were assigned to definite hospitals to follow their specialty.

Realizing that certain hospitals were better equipped to cope with neurosurgical problems than others, the Bureau of Medicine and Surgery designated certain medical centers as neurosurgical centers. At these centers, consultants in the allied fields of orthopedic surgery, plastic surgery, maxillofacial surgery, orthodontia, and other specialties were available. In the United States neurosurgical centers to which patients needing combined specialized treatment could be sent for disposition were set up at Chelsea, Mass., St. Albans, N. Y., San Diego, Calif., Philadelphia, Pa., the National Naval Medical Center, Bethesda, Md., and Oakland, Calif.

## CRANIOCEREBRAL INJURIES

*Infection.* Although it was recognized in the years between World War I and World War II that the brain and meninges were able to resist infection to a remarkable degree, Harvey Cushing, pioneer neurosurgeon, in World War I was aware that it was usually infection which caused such complications as meningitis, abscess, and encephalitis in patients with wounds of the head. He reported that the mortality rate was 36.6 percent in patients with deep wounds of the head, whereas Geoffrey Jefferson, neurosurgical consultant in the British Emergency Medical

(1) Section on Neurologic Surgery, Mayo Clinic, Rochester, Minn.

Service, estimated that it was 20 percent. In World War I, anaerobic infections, particularly gas gangrene and tetanus, complicated wounds of the central nervous system. The development of the sulfonamides and penicillin changed the prognosis for all types of wound in World War II. Much of the information concerning the treatment of wounds of the central nervous system stemmed from the early experiences of the British. Brigadier Sir Hugh Cairns, R. A. M. C., and his colleagues advocated the use of 18 gm. of sulfadiazine on the first day in the treatment of craniocerebral injuries and 12 gm. daily thereafter in the treatment of meningitis and as a prophylactic measure. The British also initiated the use of penicillin intrathecally in the treatment of meningitis caused by micro-organisms susceptible to penicillin and showed that in cellulitis of the scalp, osteomyelitis of the skull, and fungus infections of the brain the systemic administration of penicillin was of great value.

Although there were craniocerebral wounds in which pathogenic organisms gained access to the subarachnoid spaces or ventricular system regardless of the care used in operating, it was found that, by the

of infection.

Penetrating wounds of the head and retained missiles received a good deal of thought and were the cause of experimental work by the National Research Council, the Army, and the Navy. It was found that removal of a foreign body from the brain within 12 hours reduced the incidence of fatal infection. Failure of the foreign body to reach the ventricle greatly reduced the likelihood of death from a fulminating infection. At first, it was thought that an unsterile foreign body, deeply imbedded but not communicating with either the skin or ventricle, would not cause a fatal infection unless the ventricle at some time was penetrated. Early in the war, retained bone chips, rather than retained missiles, were thought to be the cause of abscess of the brain. Later, the occurrence of an abscess of the brain about a missile, although the bone chips had been completely removed, was frequent enough to direct closer attention to removal of the missile. Electromagnets used to remove bullets and steel fragments were replaced, for the most part, by the simple procedure of using a piece of magnetized steel held in a pituitary tongueur. Intracranial hematoma was uncommon in missile wounds of the brain.

It was found by the use of antibiotics that extensive reparative operations on the head for craniocerebral wounds could be delayed until the patient was transported from the front, or scene of action, to the better established hospitals where greater facilities could be maintained for the treatment of craniocerebral injuries.

*Repair of cranial defects.* Early in the war, the use of tantalum, a new inactive metal, and acrylic resin were recommended for repairing skull defects. Previous to the war, cranial defects had been repaired by sheets of celloidin and by flaps of the outer table of the skull and various metallic substances, including silver. The lack of reaction to the tissues made tantalum a safe metal to use in the repair of cranial defects. In naval hospitals equipped for the insertion of tantalum plates, the patient was carefully studied from the standpoint of repairing the defect as well as assisting in the relief of symptoms. It was early recognized that the insertion of a tantalum plate would not relieve convulsive seizures. On the other hand, it was demonstrated that, in patients in whom encephalography did not disclose any definite evidence of cystic or degenerating lesion, the insertion of a plate frequently would relieve the posttraumatic headache which had followed injury of the head.

*Convulsive seizures.* The frequent occurrence of convulsive seizures following craniocerebral injuries in warfare was the source of a great deal of concern. In determining the prognosis of penetrating wounds of the head, the fact that convulsive seizures could occur weeks, months, or years following the head injury was not forgotten. The British had found that wounds of the scalp of all kinds were followed by convulsions in 24 percent of patients, probably because the underlying injury of the brain was more severe than that which occurs with usual injuries of the scalp in civil life. The British also found that, although convulsions were more certain to follow direct injury to the sensorimotor cortex than injury to some area removed from the homunculus area, the exact site of cortical injury did not seem to have such an important bearing on the production of convulsions. The first seizure might occur within a few hours or as late as 20 years after the original injury, although the onset of the convolution usually occurred sometime during the first 2 weeks after injury.

*Prevention of injuries of the head.* For the prevention of craniocerebral injuries, Cairns perfected a protective helmet worn by motorcyclists in the British Army. The regular issue steel helmet worn by the United States soldier and marine furnished excellent protection against craniocerebral injuries, but it had not been designed for the use of the crews in aircraft or tanks and could not be used to advantage by them, mainly because of its size, shape, and weight. Colonel Loyal Davis, MC, A. U. S., designed a close-fitting helmet which was made by molding pieces of acrylic resin to conform to the frontal, temporal, occipital, and vertex portion of the skull. The pieces of acrylic resin were covered with leather and lined with chamois and fleece. Such a helmet allowed for complete movement of the head in all directions, provided complete protection over the frontal and occipital areas, and weighed 18 ounces, compared with the regulation helmet which weighed 35.84 ounces. The helmet which was designed by Davis for the Army

was adopted by marine and naval fliers early in the war and cut down the incidence of craniocerebral injuries.

*Blast injuries.* A great deal of experimental work was done at the National Naval Medical Center in analyzing the type of wounds produced by blast injuries occurring in the water and determining whether or not protection could be given. In these injuries, cerebral lesions were discovered without any wounds of the head. Cairns believed that the possibility of cerebral fat emboli had to be considered although it was not always found at necropsy.

*Naval research on injuries of the head.* Another mechanism which acts to injure the brain is the change in velocity of the head following a blow. It was shown experimentally that the velocity behind the blow and the small amount of motion allowed the brain in its closed box was the cause of many cerebral injuries, particularly in patients with closed injury of the head. When the brain lags behind the rotational acceleration forces, a type of shearing strain results. This was demonstrated experimentally at the National Naval Medical Center. Lueite plates were substituted for the calvaria in monkeys, and after the scalp had healed and the brain could be observed under direct vision, blows of differing intensity were applied to the head. Motion pictures made at the rate of 2,000 frames per second showed a definite rotational movement of the brain. Through this lueite cap, also, the brain could be observed when certain gases were injected in the subarachnoid space. The effect of anoxia, the administration of oxygen, and the administration of vasodilating chemicals could also be observed through the transparent acrylic resin cap.

At Princeton University, research on ballistics was in progress, and the lueite plate preparations of monkeys were transported there so that the explosive effect of the bullet could be demonstrated in the brain of the monkey. This experimental work was probably the greatest contribution to neurosurgery during the war because it showed without question the effect of force against the intact skull on the underlying brain and, also, the effect of penetrating missiles of different velocity. This work was reported from the National Naval Medical Research Institute during the war by Craig, Pudenz, and Shelden.

*Complications of cranial injuries.* The 3 major complications which occur following injuries of the head or operation on the brain are hemorrhage, infection, and edema. The influence of antibiotics in the surgical treatment of craniocerebral injuries was demonstrated by the low percentage of patients in whom an intracranial abscess developed. Advances in the treatment of abscesses also included sterilization of the contents of the abscess, the determination of the safety with which one could wait until the abscess wall was well established, the prevention of ventriculitis and meningitis, and, finally, the successful removal of the abscess in its entirety without the development of widespread encephalitis.

## INJURIES OF THE SPINAL CORD

One of the great problems of war was the treatment of patients with spinal cord injuries. Penetrating wounds of the spinal cord, severing the substance of the cord, are followed by complete paralysis below the level of the injury and involve the colon and bladder. The high incidence of broken backs which occur on shipboard and in landing operations is well known. Another type of injury of the spinal cord was concussion caused by the passage of projectiles, not through the spinal cord itself, but in its neighborhood, resulting in the disintegration of the spinal cord. Destruction of the substance of the spinal cord does not respond to any type of surgical treatment, but early in the war it was established that all injuries of the spinal cord should be treated by some type of laminectomy in order to be sure that fragments of bone were not compressing the cord and producing disability. The reason for this was that, even with a small amount of preservation of motion or sensation in the lower extremities, the rehabilitation of the patients was easier and more complete.

In closed wounds of the spine, such as a fracture-dislocation of the vertebral column, the application of traction frequently is followed by improvement. In patients with fracture-dislocation of the cervical segment of the spinal cord, it has become a standard practice to apply traction early by means of Crutchfield tongs attached to the skull or by a head harness to extend the neck. Decompressive laminectomy performed weeks or months after spinal cord injuries rarely benefits the patient when evidence of a complete transverse lesion has persisted without a subarachnoid block, but its use should be considered.

The open wounds of warfare require meticulous débridement. It was common practice in World War II to remove all bone fragments and to cleanse the wound without opening the dura in the potentially infected field. Indirect spicules of bone and foreign bodies, if accessible, were removed. Dural rents were closed by suture, if possible, or by the application of living fascial grafts in order to stop the leakage of cerebrospinal fluid. The addition of systemic chemotherapy also was of great assistance in dealing with wounds of the spinal cord.

The nursing of patients with injury to the spinal cord proved to be quite complicated in view of the loss of control of the bladder and rectum. The use of indwelling catheters and regulated enemas aided in the prevention of decubitus ulcers. Tidal drainage was successfully used in some neurosurgical centers but in others, cystostomy was used to empty the bladder. Drainage by an indwelling catheter, the development of an automatic bladder, and the transurethral section of the hypertrophied sphincter contributed to the rehabilitation of the patients.

Nutrition of the patient was important and the value of a correct concentration of blood protein and a normal albumin-globulin ratio was demonstrated repeatedly. The diet was carefully supervised to provide

a high protein intake and an average daily intake of about 2,800 calories. A high vitamin diet also aided in improving the status of the bladder. The patients were urged to take large amounts of fluids.

The prevention of decubitus ulcers was found to depend on good nursing care. When they occurred, however, in spite of adequate nursing care and nutrition, they were treated with the meticulous care necessary to prevent further infection. Excision of the ulcer and the use of free skin grafts or rotatattoo skin grafts hastened healing.

**Vesical problems.** The establishment of automatic micturition was one of the chief problems in the rehabilitation of patients with injuries of the spinal cord. The establishment of efficient urinary function was one of the primary goals in the care of these patients. In previous wars, the appalling death rate among the men who had sustained an injury of the spinal cord was caused by urinary sepsis. Although tidal drainage was used extensively in some service hospitals, it required the attention of a doctor, a nurse, and a technician. It was not a simple, self-regulating mechanism, but it did afford a means of continuing cystometric study and assisted in minimizing the bladder infection which tended to occur in spite of medication. It seemed to be the only certain and safe means of retaining the bladder for automatic function.

Various methods of urinary drainage which were used in the early days of the war included (1) allowing the bladder to distend and overflow, (2) manual expression of urine, (3) perineal urethrostomy, (4) suprapubic cystostomy, (5) repeated urethral catheterization, and (6) the use of an indwelling urethral catheter. Under favorable conditions automatic micturition may develop and continue regardless of the level of the lesion, but it develops most rapidly when the lesion is below the seventh cervical segment and above the fifth thoracic segment. In the presence of a lesion of the lower part of the thoracic segment or a caudal lesion associated with contraction of the abdominal muscles, such signs as (1) a feeling of abdominal distension, (2) burning or tenseness in the genitalia, (3) suprapubic cramping sensations, and (4) burning and drawing sensations in the lower extremities, produce an awareness of a full bladder. When the lesion is situated above the ninth or tenth thoracic segment, distention of the bladder and a warning of impending micturition may be manifested by such signs as flushing of the face, arms, and thorax. On becoming aware of such symptoms, many patients are able to initiate micturition by such stimuli as massaging the lower abdominal wall, rubbing the skin of the inguinal region, and tugging on the spermatic cord. Many patients were found to have a greatly hypertrophied vesical neck after the development of an automatic bladder, and transurethral resection of the ring of the hypertrophied muscle was successful in producing a state of automatic micturition with almost complete emptying every 1 to 3 hours.

In observing patients with injuries of the spinal cord, it has been found that automatic micturition will develop after complete severance at any level within the spinal cord or cauda equina. This phenomenon appears earlier and with greater efficiency in the presence of lesions between the seventh cervical and fifth thoracic segments. It does not appear in the presence of incomplete severance of the cord, although the effect of extravesical stimuli on the initiation of micturition may be quite similar in the case of either a complete or a partial severance. Automatic micturition may occur with remarkable regularity at intervals as long as 3 hours but with very low efficiency as determined by a large amount of residual urine. Lesions of the cauda equina do not produce the striking visceral reflexes such as flushing, perspiring, headache, and reverse peristalsis. Automatic micturition will develop only when there is no mechanical obstruction of the bladder and when the sphincter is capable of reflex relaxation. Automatism will not develop in a patient in whom severe vesical sepsis, multiple calculi, or severe debilitation is present.

*Pain in the extremities.* Another complication encountered in the rehabilitation of patients with injuries of the spinal cord is the persistence of pain in the extremities. This has been treated in a number of ways, including rhizotomy, thizotomy, and the intrathecal injection of alcohol. The release of abnormal reflex activity has been treated by injection of alcohol and by resection of the motor root. Because each patient is different, no general rules can be laid down regarding the treatment of this complication.

#### PROTRUDED INTERVERTEBRAL DISKS

One of the perplexing problems encountered by neurosurgeons in the Army and Navy was ruptured nucleus pulposus associated with low back pain and sciatic pain. Because this problem also had been encountered in civil life, an attempt was made to devise a method of treatment that would decrease the number of service-connected disabilities. It soon became apparent, however, that operations for the relief of low back and sciatic pain caused by herniated nucleus pulposus in the different theaters of operation were unsuccessful in most cases and that the patients had to be returned to hospitals in the United States which were equipped to take care of them.

A statistical study which was carried out at the U. S. Naval Hospital, National Naval Medical Center, Bethesda, Md., disclosed that only 62 percent of the enlisted men returned to duty after operations for the relief of pain caused by ruptured nucleus pulposus whereas almost 100 percent of the officers similarly afflicted returned to duty. The operation of choice was a limited type of hemilaminectomy which had been introduced before the war. It was found that a certain percentage of patients who suffered from low back and sciatic pain also had either changes in the bony structure or definite lesions such as spondylolisthesis which contributed to the back pain. The combined opinion of a

neurosurgeon and an orthopedist was obtained with regard to the necessity for fusion following removal of the disk in all these cases. A fusion operation was performed on a certain percent of these patients.

### INJURIES OF PERIPHERAL NERVES

The treatment of injuries of peripheral nerves probably showed as much progress as any type of treatment of injuries of the central nervous system. The treatment of injuries of peripheral nerves was aided by experimental research as planned and implemented through the Office of Scientific Research and Development of the National Research Council during World War II. Among the advances which contributed to this progress were (1) Tarlov's work on the use of plasma glue to facilitate the union of nerve ends which could be approximated without tension, (2) the local use of sulfonamides to aid nerve regeneration, (3) the study of the traumatic degeneration produced by the concussive effect of gunshot wounds in which the nerve trunks were not severed, (4) the development of new staining methods to demonstrate the different patterns of nerve regeneration after end-to-end suture, (5) the use of autogenous and homogenous grafts, and (6) the elaboration of electromyographic methods for the study of the denervated and reinnervated muscles.

**Electrodiagnosis.** One of the most important contributions which was made during the war in the treatment of injuries of peripheral nerves was the observation that a second operation should be performed on patients in whom the injured nerves did not show any evidence of regeneration within 3 months after primary suture. In a large number of patients the second operation disclosed that the ends of the sutured nerves had become separated because of motion or tension. For that reason, certain electrodiagnostic procedures were developed. The changes of response to galvanic stimulation which characterize the complete reaction of degeneration are: (1) hyperirritability of the muscle to galvanic stimuli, (2) sluggishness of the relaxation of the contraction wave, (3) lessening of the ratio between the amperage necessary to produce tetanic contractions and the rheobase to almost unity, and (4) increase in the efficacy of anodal closing stimuli to equality with those of cathodal closure. The practical application of electrodiagnostic methods allowed evaluation of the regeneration at an earlier date than observation. After a sufficient time has elapsed and the characteristics of denervation are not found by electrodiagnosis, the nerve is spontaneously recovering and should not be operated on. If, after a severed nerve has been sutured, the characteristics of the denervated state are not found, it may be assumed with certainty that recovery is taking place. When a sufficient time has elapsed after nerve injury for regeneration to have occurred and the characteristics of denervation are found, the nerve must be operated on. Thus it was that electrodiagnosis was of help in determining on which patients operation should be performed.

*Co-operative treatment.* One of the great problems in the treatment of nerve injuries was the fact that the injuries of the nerves frequently were associated with injuries of the bones, muscles, and skin. Thus it was apparent early in the war that the combined efforts of the plastic surgeons, the orthopedists, and the neurosurgeons were essential in treating peripheral nerve injuries because, instead of treating the injury of the peripheral nerve itself, the entire extremity had to be treated. This eliminated a great deal of controversy with regard to the use of splints, the application of braces, and the delayed treatment of fractures. The results of treatment of injuries of peripheral nerves were much more satisfactory in the neurosurgical centers where there was complete co-operation between the different departments. The department of physical medicine also played its part in the treatment of injuries of peripheral nerves, the use of passive motion and massage of the extremities contributing to the preservation of function of joints and muscles.

*Pathology.* The use of new staining compounds which were developed during the war years revealed that mesodermal tissues were the first to react by proliferation after any nerve injury. This proliferation occurs at the site of the lesion and extends into the gap between the severed nerve segments, into the degenerated distal nerve segment, into the perineurium and epineurium of the central segment, and into the distal segment of the nerve. Regenerating nerve fibers follow the path of proliferating histiocytes and collagenous fibers. This observation appeared to be evidence against the generally accepted theory that the regenerating distal segment of the end of a cut nerve exerts a hematropic influence on regenerating nerve fibers growing out of the end of the central stump. Mesodermal tissue plays a primary role in the organization of autogenous and homogenous grafts in laying down a scaffolding which is followed by regenerating nerve fibers. Depending on the degree of survival of the mesodermal elements in the graft and the degree of necrosis which occurs, this scaffolding follows the original nerve structure, or becomes irregular, deviating, and confused in its course and thus influences the course and the efficacy of the regenerating nerve fibers.

*Disintegration in continuity of nerves.* One of the most difficult problems in the treatment of peripheral nerve injuries occurred in patients with gunshot wounds in which the continuity of the nerve had not been interrupted. Extensive traumatic injury was found in the nerves at the site of the trauma and injuries of peripheral nerves frequently were evident in patients in whom the missile had not penetrated the nerve but had passed through the adjacent tissue. It was difficult to realize that definite degeneration of long segments of a nerve could take place, both centrally and peripherally, as a result of this type of injury.

*Nerve suture.* Young and Medewar, in England, and Tarlov, in this country, carried out a series of experiments by using concentrated

blood plasma gel to unite the ends of divided nerves. This method of repairing nerves was put to a practical application in the U. S. Naval Hospital, St. Albans, N. Y. This method was used in a series of cases, and, at the same time, suture with silk, nylon, or tantalum wire was used in another series of cases. Experiments on the use of different types of sutures were carried out at the National Naval Medical Center. It was found that those sutures which caused the least reaction in peripheral nerves were human hair, nylon, silk, and tantalum wire. The use of catgut was not advised because of the marked reaction of the nerve cells about the suture.

*Causalgia.* One of the great problems in treating injuries to extremities was the painful syndrome which had been called "causalgia." Causalgia and the pain of phantom limb were similar, and operations on the sympathetic nervous system with denervation of the affected limb was followed by relief of pain in a high percent of patients.

### A NEUROSURGICAL HEADREST

The technic of certain neurosurgical operations has been standardized by placing the patient in a sitting or upright position. In some clinics, dental chairs were converted for use in these procedures; in others, elaborate appliances were constructed which could be attached to the operating tables, or various special tables were designed for this purpose. Shortly after the beginning of the war, it became apparent that the hospitals of the Armed Forces needed an attachment that could be applied to an ordinary operating table. From a practical standpoint, this attachment had to be inexpensive, relatively small, and had to combine certain essential features that could be universally used by the Army as well as the Navy. At the Naval Medical Center, Bethesda, Md., such an apparatus was designed and a rough model was tried. It proved valuable for operations on the brain and cervical portion of the spinal cord.

Removal of cerebellar tumors, resection of the acoustic and glossopharyngeal nerves for Ménière's disease and glossopharyngeal neuralgia, hemilaminectomy in the cervical region of the spinal cord for protruded intervertebral disks and tumors, and various other operations about the neck and head have been facilitated by having the patient in the upright position. The escape of blood and cerebrospinal fluid by gravity leaves the operative field clean and the exposure unobstructed. This upright position has been used almost universally for the section of the trigeminal nerve for the relief of trigeminal neuralgia. Certain other operations on the parietal and temporal region of the head can be performed with greater ease if the patient is in this position.

One of the great objections to the use of the upright position for neurosurgical operations has been the variations which occur in the blood pressure during the operation and the necessity of lowering the head of the patient in the course of the surgical procedure. The head-

rest in question obviated this danger as the patient could be placed in the sitting position with the feet elevated to the level of the head. As a further precaution it was found that splinting the vascular bed of the lower extremities had a most profound stabilizing effect on the blood pressure. If the legs were wrapped in ordinary bandage of one thickness from the ankle to the groin, even when the operation was performed under general anesthesia, the blood pressure would not vary unless there was an extraordinary loss of blood in the course of the operation.

The headrest consists of a bar which can be attached to the stirrup rods which are standard equipment of the operating table. To this bar is attached a movable and adjustable headrest in which the head can be fitted in almost any position for suboccipital operations, ventricular drainage, and cervical laminectomy. For the lateral approach, the head can be adjusted so that a proper exposure of the temporal or parietal area can be obtained. The entire apparatus was so constructed that the patient could be in the center of the table for a posterior approach or could be placed to the right or left of the midline for temporal or parietal operations.

#### A NEUROSURGICAL FLYING UNIT

The limited number of adequately trained neurosurgeons made it important that they be used wisely. The Surgeon General of the United States Navy was cognizant of this fact and suggested the formation of a flying neurosurgical unit to be stationed at the National Naval Medical Center, Bethesda, Md. This unit was authorized in July 1942. It was to be ready to answer emergency calls along the East Coast during a possible token bombing by the enemy. The Surgeon General realized that adequate operations on the brain, peripheral nerves, and spinal cord require certain special equipment which is not available in all service hospitals. He also realized the importance of a trained surgical team consisting of surgeon, assistant surgeon, anesthetist, nurses, and hospital corpsmen.

Experiences had shown that, in the management of injuries of the brain and spinal cord, transportation of the wounded to the nearest hospital where adequate care was available resulted in a lower mortality rate and a more satisfactory convalescence. Because it was realized that bombing of the Atlantic coast might result in a great number of injuries to the central nervous system at a place where adequate neurosurgical care was not possible, this flying neurosurgical unit was maintained throughout the war to augment the staff and equipment of the hospitals along the coast in an emergency. Such a unit with all necessary equipment had, by necessity, to be transported by air to any point where urgently needed. This would not only assure specialized surgical care in widely separated areas, but would greatly reduce the need of a complete neurosurgical team in every hospital where these injuries might have to be treated.

The neurosurgical flying unit which was developed at the National Naval Medical Center consisted of a neurosurgeon, an assistant neurosurgeon, an anesthetist, and a hospital corpsman. The entire equipment was so assembled that the four men comprising the team could transport it from the hospital to the flying field in a station wagon or ambulance, carry it to the plane, and arrange for transferring it to the hospital where needed. A small portable electrosurgical unit, a fiber case for neurosurgical instruments, a small portable suction unit, and a portable operating table were procured. Suitable carrying cases were needed for the towels, sheets, gloves, pans, gowns, and gauze. These carrying cases were, of necessity, light and easily handled. For this purpose, marine sea bags on which handles were sewn were procured. A list of the contents of these bags was typed on linen, and sewn on the flaps so that the bags could be taken to the central supply room and filled when needed. Articles were checked as they were put in.

Six marine bags were found to be sufficient for transporting the necessary supplies and they were light enough to permit them to be carried by hand. The supplies contained in the marine sea bags—the electrosurgical unit, the suction apparatus, the fiber case of neurosurgical instruments, and the portable operating table—proved to be sufficient for emergency neurosurgical procedures to be performed either in an equipped operating room or in an emergency room, in a school-house or in temporary hospital quarters, and the transportation of this entire unit by plane to any part of the country was possible. Forty minutes after the unit was alerted, the instruments could be sterilized, the supplies assembled, and the unit could be on the way to the airport. In similar bags were transported all necessary solutions such as plasma, serum albumin, saline solution, and pentothal sodium along with equipment for giving fluids intravenously. Four medical kits containing all necessary incidental items for proper surgical care were also included. The weight of these items is shown in table 1.

TABLE 1. Weight of equipment

1 first aid kit . . . . .	12½ pounds
1 suction apparatus . . . . .	23 pounds
1 fiber case of instruments . . . . .	73 pounds
1 operating table . . . . .	.87 pounds
1 electrosurgical unit . . . . .	70 pounds
1 first pack . . . . .	50 pounds
1 second pack . . . . .	52 pounds

This flying neurosurgical unit was evidence of the foresight and planning of the Bureau of Medicine and Surgery to meet any emergency which might arise in a global war. It was available at all times and was so equipped that any type of neurosurgical problem could be promptly and adequately treated regardless of the local condition encountered.

#### COMMENT

No history of any period is complete without a comment on the mistakes which have been made. Among the mistakes which were made

during World War II was the immobility of the surgical specialists. It stands to reason that during peacetime the number of surgical specialists needed to take care of civilians is not as great as it is during time of war. In the tables of organization of naval hospitals, hospital ships, and dispensaries, the surgical specialties, particularly the specialty of neurosurgery, should be eliminated and neurosurgical teams and consultants should be mobile. Although it is difficult to determine the incidence of injuries to the central nervous system during World War II, a few reports have indicated that the central nervous system is involved in about 10 percent of all casualties. It stands to reason then that it is a waste of time and talent to immobilize a neurosurgeon to take care of 10 percent of the wounds which come to a naval hospital. It might be well to create neurosurgical teams which could go about wherever they are needed and be available as indicated. The mobility of the neurosurgeons in setting up the table of organization for another world war should certainly be encouraged—or at least the neurosurgical consultant in a certain area should be responsible for the neurosurgical activity in certain hospitals. Only in this way will it be possible to take care of the neurosurgical wounds satisfactorily and to supervise the rehabilitation of patients suffering from injuries of the central nervous system.

#### SUMMARY

Neurosurgery is a specialty of surgery requiring a background of fundamental knowledge of general surgical principles, of neurology, and of the allied specialties of ophthalmology and roentgenology. During World War II the many advances in these fields contributed greatly to the better care of neurosurgical patients. The use of antibiotics greatly reduced the incidence of infection and allowed for primary closure of wounds. The use of plasma early in the treatment, followed by transfusions of whole blood, played its part in the healing of wounds. Particular attention to water balance, electrolytes, balanced intake of protein and a high protein maintenance diet, the administration of vitamins, good nursing care, and careful attention to the cleansing of wounds all played a part in the successful treatment of neurosurgical wounds in World War II.

Major advances in neurosurgery included the introduction of such hemostatic agents as fibrin foam, oxycel or oxyiodized gauze, which was absorbed, and gelfoam. There were advances in the repair of cranial defects and considerable research was done on head injuries. The importance of performing some type of laminectomy on patients with injury of the spinal cord was established and there were new developments in methods of initiating efficient vesical function to avoid urinary sepsis. Good nursing care in these cases was recognized to be of extreme importance. Much progress was made in the treatment of injuries of peripheral nerves, among them the use of plasma glue for uniting divided ends of nerves, the development of sutures which were neutral and did not create reaction on the part of the tissues, and the use of electrodiagnostic methods.

## BOOK REVIEWS

**Chest X-ray Diagnosis**, by Max Rivo, M. D., Assistant Professor of Radiology, Harvard Medical School; Instructor in Radiology, Tufts Medical School, Roentgenologist-in-Chief and Director, Department of Radiology, Boston City Hospital; Associate Radiologist, Beth Israel Hospital, Boston, Mass.; Radiologist, Jewish Memorial Hospital, Jewish Tuberculosis Sanitorium of New England, Revere Memorial Hospital, and Hudson Hospital. 558 pages, 615 illustrations. Lippincott, Philadelphia, Pa., publisher, 1951. Price \$15.

This comprehensive compilation of the diseases affecting the thoracic organs, with descriptions of their roentgen manifestations and with discussions of diagnostic criteria, is divided into the following sections: (1) the lungs; (2) the mediastinum; (3) the diaphragm; (4) the pleura; (5) the bony thorax and the soft tissues of the chest wall; (6) the soft tissues of the neck; (7) the heart and great vessels; (8) the aorta; (9) the pulmonary artery; and (10) the pericardium. The subject is well organized. The writing is clear and concise. Pertinent clinical data regarding the various disease entities are included. It is pleasing to note that all roentgenograms are reproduced as negatives and that almost all of the reproductions are of good quality. This volume is handsomely printed and well bound. It is a pleasure to read. The work is a worthwhile addition to the library of the student of roentgen diagnosis and the author and publisher are to be congratulated on its excellency.

—Capt. C. E. Bentel, MC, U. S. N.

**Pediatric Allergy**, by Robert Chobot, M. D., Assistant Clinical Professor of Pediatrics, New York University-Bellevue Medical Center, Director of the Pediatric Allergy Clinic, University Hospital of New York University-Bellevue Medical Center; Consultant to Allergy, Downtown Medical Center; Assistant Physician, Allergy Clinic, Roosevelt Hospital. 284 pages, illustrated. McGraw-Hill Book Co., Inc., New York, N. Y. Price \$4.50.

This small well-written volume describes in detail the diagnosis and treatment of allergic diseases of children. The emphasis is definitely on the clinical aspects of the subject with only the first short chapter devoted to the experimental and historical aspects of allergy. The author most eloquently states his opinion regarding the importance of foci of infection in causing every kind of allergic disease in childhood, while admitting that this subject of so-called "infective" allergy is controversial and not emphasized by many allergists. The usual allergic respiratory diseases are well covered and, in addition, drug allergy, migraine, allergy of the eye, and allergic skin diseases are briefly reviewed. The probable eventual limited uses of ACTH and cortisone are indicated.—Col. W. H. Diessner, MC, U. S. A.

# Psychoneuroses

## Military Applications of a Follow-up Study (1)

Norman Q. Bull, M. D.

Gilbert W. Beebe, Ph. D.

FOR the past several years a follow-up study of military psychoneuroses has been conducted. Following the outbreak of hostilities in Korea, we were requested by the Chief of the Research Division, Veterans Administration, to review our findings to determine their possible military application. After consultation with the Chief of the Psychiatry and Neurology Consultants Division, Office of the Surgeon General, Department of the Army, it was decided to examine our data from the standpoint of the existing induction policy regarding psychoneuroses. In addition, we studied the possible applicability of the data to utilization and discharge policies because these are inevitably linked with the induction policy.

The emotional health of a person and the nature of his adjustment in civil life can be determined fairly readily (although not very accurately) from a relatively brief psychiatric interview. We, therefore, studied these items in our data to learn to what extent knowledge of them in any given case would be of help in deciding for or against induction, for or against return to duty if hospitalized, and the method of discharge if return to duty was not possible. We attempted to relate military performance and condition on follow-up several years later to such factors as: (1) preservice personality (in terms of degree of emotional disorder); (2) impairment in general functioning before entry into service; and (3) preservice adjustment in such areas as school, work, family, and sex.

### PROCEDURE

The study consisted essentially of three phases. The first phase was the selection of a representative sample of Army and Navy enlisted

(1) From the Department of Psychiatry, George Washington University School of Medicine. Dr. Winfred Overholser, Professor of Psychiatry and head of the Department, was the responsible investigator. The study was supported by a contract with the Veterans Administration and constitutes part of the cooperative program of follow-up studies developed by the Committee on Veterans' Medical Problems, National Research Council, and the Veterans Administration with the aid of the Army and Navy.

men treated for a psychoneurosis (with loss of at least 1 day of duty) in World War II (2). Men who were treated solely on an outpatient basis were excluded. The sample consisted of 290 Navy and Marine Corps personnel admitted for psychoneurosis during the period 1942 to 1945 and 665 Army enlisted men admitted in 1944. The second phase consisted of the examination, by selected psychiatrists throughout the country, of as many of the men as would cooperate. The follow-up interval averaged about 5 years between treatment for psychoneurosis in the service and re-examination in civil life. Sixty-two percent were examined by psychiatrists and for the rest information was obtained from military and Veterans Administration medical and personnel records, Red Cross social histories, other Red Cross reports, and questionnaires. The third phase embodied coding, tabulation, and analysis of the details of family history, preservice personality and adjustment, military stress, military career, nature of the breakdown, treatment received, condition on discharge from the service, treatment and course of illness since service, condition and adjustment on follow-up, attitudes toward illness and military service, compensation received for illness, and prognosis.

TABLE 1. Distribution of patients by preservice personality

Preservice personality	Distribution	
	Number	Percent
Well integrated	122	14.2
Neurotic traits	292	34.0
Suggestive neurosis	140	16.3
Overt neurosis	125	14.6
Pathologic personality*	172	20.0
Latent or overt psychosis	3	0.4
Posttraumatic syndrome, organic	4	0.5
Subtotal	858	100.0
Unknown	97	
Total	955	

\*Includes 36 patients (3.8 percent) with behavior disorders.

## RESULTS

### Preservice personality

Each patient was classified as to preservice personality. The categories used and the distribution of patients are indicated in table 1. The classification was not that which was established when the pa-

(2) For convenience, the loss of time from duty will be referred to hereafter as "breakdown." In some instances hospitalization was the result of chronic inability to adjust in the service with no significant change in the type or severity of symptoms, whereas in others it followed a sudden decompensation.

tient was inducted. It is believed that if the information on which the classification was based had been available to the psychiatric examiner at the time of induction, the same evaluation could have been made. The information, largely provided by the men themselves during a 1- to 4-hour interview, is in all probability at least as reliable as that which can be obtained in an induction examination. It might be expected that at follow-up men might be prone to minimize any difficulty they had prior to service, and that during service they might have exaggerated it. Where discrepancies were seen, an attempt was made to evaluate and combine the information from both periods.

Significant relationships were found between pre-service personality and all the indexes of military usefulness which we selected for study, namely: (1) total length of service, (2) percent serving overseas, (3) average length of overseas service, (4) admission rate, (5) court-martial rate, (6) incidence of awards and decorations, including Purple Heart, (7) length of service prior to breakdown, (8) MOS at time of breakdown, (9) mission of unit at time of breakdown, (10) admission rate prior to breakdown, (11) major area of stress precipitating breakdown, (12) location (in military career) at time of breakdown, (13) duration of combat prior to breakdown, (14) severity of stress prior to breakdown, (15) length of service after breakdown, (16) type of separation from service, (17) admission rate after breakdown, (18) disposition from hospital, and (19) quality of duty performed after breakdown. The numerical values of these indexes are shown in table 2 for each personality group.

#### Performance

1. *Overtly neurotic group.* The average length of service before breakdown was 13.2 months. During this time 80 percent of the Army and Marine Corps veterans had either been assigned or already reassigned to a relatively nondangerous MOS and 20 percent had dangerous MOS's (3). That an overt neurosis prior to entering the service was not always associated with early breakdown is shown by the fact that 18 percent did not break down until exposed to the stress of combat. Those who reached combat remained for an average of 4.1 months in combat before they broke down (not significantly different from the other groups). A breakdown in a person with a pre-existing overt neurosis did not necessarily result in medical discharge. Although this group did not render very effective service after breakdown, only 70 percent were ultimately discharged for psychoneuroses.

Fifty-seven percent were medically discharged without ever returning to duty after the first hospitalization. At the other extreme, 10 percent returned to duty without reassignment. How many of these were already in nondangerous and in dangerous assignments has not yet been deter-

(3) Riflemen, gunners, and men assigned to intelligence, reconnaissance and security work were considered to have dangerous MOS's; assignments in communications, transportation, supply, maintenance, medical, construction, technical, and administrative work were considered relatively nondangerous.

TABLE 2. Military performance of presence personality groups

	Normal	Neurotic traits	Suggestive neuroses	Overt neuroses	Pathologic personality
<i>Total period of military service</i>					
Mean months of service	36.1	31.7	22.6	21.8	32.8
Percent serving overseas	85.7	76.6	43.9	32.4	69.1
Mean months overseas	18.1	12.7	6.8	5.5	12.2
Admissions per 1,000 men per year, all causes	1,086	1,229	1,340	1,482	1,484
Admissions per 1,000 men per year, psychoneurosis only	428	461	642	756	490
Court-martial per 1,000 men per year, all causes	68	66	72	71	214
Percent receiving Purple Heart	18.0	15.1	3.6	1.6	10.5
Percent receiving other awards and decorations	9.0	7.5	2.1	1.2	1.2
<i>Period prior to breakdown</i>					
Mean months of service	23.6	22.5	14.1	13.2	23.8
Percent with dangerous MOS at breakdown	46.8	49.8	34.3	20.2	38.1
Percent assigned to combat units at breakdown	68.8	62.2	41.9	32.1	44.8
Admissions per 1,000 men per year, all causes	696	826	825	936	1,069
Percentage breaking down under no stress	1.0	1.2	9.4	12.6	8.6
Percentage breaking down under no or mild stress	32.1	41.3	74.3	83.7	53.9
Percentage breaking down under combat areas	69.5	58.4	27.1	17.9	47.5
Percentage breaking down prior to overseas shipment	18.9	21.7	57.7	62.3	33.9
Mean months of ground combat of men with combat experience	3.28	2.32	2.74	2.74	3.51
<i>Period after breakdown</i>					
Mean months of service	12.6	9.3	8.4	8.6	9.0
Percent with medical discharge for psychoneurosis	38.5	57.5	57.1	69.6	61.6
Admissions per 1,000 men per year, all causes	834	906	781	926	1,254
Percent returned to duty without reassignment	26	14	13	10	13
Percent with good and continued service, if returned to duty	31.9	24.7	17.6	13.0	13.8

mined. The average length of service after breakdown was 8.6 months (of which about 2 months were spent in hospitals). The admission rate for all causes was essentially the same as before breakdown. The admission rate for entire period of service (1,482 per 1,000 men per year) was more than double the average rate for the Army and Navy for the war period.

2. *Well-integrated, normal group.* The performance of the normal group differed markedly from that of the overtly neurotic. Four times as many broke down in combat; nearly 3 times as many served overseas; nearly 3 times as many were returned to duty after breakdown; and the average length of overseas service was 3 times as great. In 70 percent the major area of stress was combat and 46 percent broke down in combat after an average of 3.3 months in combat. The incidence of combat for the normal group was much higher than that for the Army and Navy as a whole, reflecting the fact that it is combat, in very large part, which precipitates breakdown. It is highly probable that this normal group was composed of different types of persons who were indistinguishable at induction. At one extreme were those with a latent neurotic difficulty, who, like the majority in the neurotic group, break down under the relatively mild stress of military training and service in the zone of the interior; and at the other extreme were the relatively stable persons who "break" only under the severe stress of combat.

Twenty-one percent were medically discharged without being returned to duty. At the other extreme, 26 percent were returned to duty without reassignment. The group served an average of 12.6 months after breakdown, roughly 1.5 months of which were spent in hospitals.

3. *Groups with neurotic traits and suggestive neuroses.* In almost all respects the performance of these groups fell between that of the normal and overtly neurotic group, the group with neurotic traits approximating the performance of the normal group and those with suggestive neuroses approximating the performance of the overtly neurotic group.

4. *Group with pathologic personalities.* This group (which includes but is not confined to those with behavior disorders) showed variable performance in comparison with the other groups. By most criteria (percent serving overseas, average length of overseas service, Purple Heart awards, combat, severity of stress, and length of service after breakdown) its performance fell between that of men with neurotic traits and that of men with suggestive neuroses. With respect to total length of service, length of service before breakdown, and average time in combat (for those who were in combat), they resembled the normal group, but they showed the highest admission and court-martial rates, the latter being 3 times as great as those of the other groups. Part of the difference in relative frequency of courts-martial is associated with the poorer educational status of this group. In general the court-martial rate decreases as the educational level increases.

TABLE 3. Distribution of patients by degree of preservice psychiatric impairment

Psychiatric impairment	Distribution	
	Number	Percent
None	395	51.1
Questionable	118	15.3
Mild	169	21.8
Moderate	81	10.5
Marked	10	1.3
Subtotal	773	100.0
Unknown	182	
Total	955	

*Preservice psychiatric impairment and adjustment*

In addition to the evaluation of preservice personality, an estimate was made of the extent to which there was impairment in general functioning, with ability to work being used as the chief criterion. Impairment was partly revealed by the personality evaluation. A normal, well-integrated personality or suggestive neurosis presupposed an absence of impairment. An overt neurosis implied some impairment. The distribution of the sample by degree of preservice psychiatric impairment is shown in table 3. Preservice adjustment was considered in each of the following areas: family, sex, school, work, social and recreational life, community, and marriage. It was then summarized in a single judgment, as shown in table 4. Tabulations were made which paralleled those used in exploring the predictive value of the preservice personality.

TABLE 4. Distribution of patients by summary of preservice adjustment

Preservice adjustment	Distribution	
	Number	Percent
Satisfactory (adequate or better) in all areas	178	21.2
Questionable in one or two areas, none impaired	154	22.0
Questionable in three or more, or impaired in one or more areas	476	56.8
Subtotal	833	100.0
Unknown	117	
Total	955	

Significant relationships were found but in no instance were they greater than those obtained with preservice personality, and in most instances they were not as great. It seemed quite clear that, of the 3 major preservice characteristics studied (preservice personality, impairment, and adjustment), personality was the most valuable predictive factor.

*Predictive value of combinations of preservice personality with other items*

Attempts were made to determine whether any other summary factor could be added to preservice personality in order to improve predictions of military effectiveness. Generally negative results were obtained, with the following exceptions:

1. None of those having both an overt neurosis and a moderate or marked impairment at entry into service, and returned to duty after breakdown, gave effective service thereafter. This was in contrast to 22 percent for men with an overt neurosis but whose impairment was only mild.
2. There was a suggestion that a previously well-integrated person, with a family history not known to be positive in the psychiatric sense, was returned to duty without reassignment more frequently than one with a poor family history.
3. When the patient's evaluation of his own health (4) on entry into the service was considered together with preservice personality, improved prediction resulted for those two areas of performance which were studied. Only 15 percent of the normal group and those with neurotic traits, who said their health at entry was excellent, broke down in the zone of the interior, in contrast to 37 percent in these personality-groups who said their health was less than excellent. The average percent with breakdown in the zone of the interior, regardless of their health evaluations, was 19 for the normal group and 22 for those with neurotic traits. Again, when each personality group was divided into those who reported their preservice health as excellent and those who said it was less than excellent, and these two subgroups were compared as to major area of precipitating stress, better prediction was obtained than with preservice personality alone. Table 5 summarizes the data on each group. When the man's own evaluation of his health at entry was used to subdivide the well-integrated group it was found that the rate at which those who said their health was less than excellent broke down in combat approximated that of the neurotic group. Similarly, by subdividing the overtly neurotic group, men with a distinctly better military prognosis could be isolated. Of those who said their health was excellent, 38 percent broke down in combat in contrast to 12 percent who said their health was less than excellent.

(4) This is the man's reply (on follow-up) to the direct question "How was your health when you entered the service?" It was possible for a man to claim his health was excellent and be classified in the overtly neurotic group. Similarly a man classified as well-integrated could have stated that his health was less than excellent.

More accurate prediction of military effectiveness was possible when a man's own evaluation of his health on entering the service was considered in conjunction with an objective appraisal of his emotional status. Further study along these lines should be fruitful. It is likely that the man who considers himself ill has, to a greater extent than the one who does not, accepted his emotional difficulty as a limitation and adjusted himself to a lower level of activity. The man who tends to deny his difficulty or not accept it as a limitation is apt to show greater resistance to stress up to a point. So far, there is nothing to indicate that this latter man is sicker when he does decompensate in a military setting.

TABLE 5. *Percent of patients having combat as major area of precipitating stress, by preservice personality and declared health on entry into the service*

Preservice personality	Declared health on entry		
	Excellent	Other	Total
Well-integrated and adjusted	76*	30*	70
Neurotic traits	62	52	58
Suggestive neurosis	26	26	27
Overt neurosis	38*	12*	18
Pathologic personality	51	33	47

\*Horizontal differences between paired percentages are statistically significant at the 5 percent level, the others not. For all personality groups combined, the evidence is that declared health at entry provides additional information.

#### *Follow-up status*

From a narrowly military standpoint, what happens to a man after he has been discharged may be of no great consequence, but because decisions about induction policies are partly premised on the need to minimize the national economic and medical burden of disability, the status of the sample at re-examination after about 5 years is of interest. Each of the summary preservice factors was examined in relation to the major indexes of follow-up status.

1. *Follow-up status in relation to preservice personality.* The various criteria of follow-up status and the results obtained with each are shown in table 6.

a. *Psychiatric disability.* Relative disability at follow-up differed significantly among the various preservice personality groups. Five times as many of the overtly neurotic and 6 times as many of those with pathologic personalities were found to have at least moderate disability as compared to the normal group.

b. *Adjustment summary.* Over twice as many of the overtly neurotic group and 3 times as many of the pathologic personality group showed some impairment in general adjustment at follow-up as compared to the normal group.

TABLE 6. *Follow-up status of preservice personality groups*

Follow-up status	Normal	Neurotic traits	Suggestive neuroses	Overt neuroses	Pathologic personality
Percent with at least moderate disability at follow-up	7.9	24.4	20.9	39.4	50.3
Percent with impaired adjustment at follow-up	26.3	50.2	38.0	61.9	73.5
Percent with illness more severe than mild psychoneurosis (including pathologic personality)	10.7	35.2	29.7	50.0	66.5
Percent drawing no disability compensation	54.6	42.2	66.7	58.8	49.4
Percent with poor prognosis	8.0	20.1	19.3	41.1	47.8

c. Psychiatric diagnosis. The specific psychiatric diagnosis at follow-up can be expected to parallel the degree of disability to a great extent because a quantitative element is included in the diagnosis (mild, moderate, severe). Nearly 5 times as many of the overtly neurotic group and 6 times as many of the pathologic personality group were diagnosed as having more than a mild psychoneurosis as compared to the normal group.

d. Disability compensation. Forty-seven percent of the men in the sample were drawing disability compensation. There is no more than a suggestive relationship between preservice personality and disability payment.

e. Examiner's prognosis. Five times as many of the overtly neurotic group and 6 times as many of the pathologic personality group had a distinctly unfavorable prognosis (without the possible effect of treatment being considered) as compared to the normal group.

TABLE 7. *Follow-up status of preservice impairment groups*

Follow-up status	None	Questionable	Mild	Moderate or marked
Percent with at least moderate disability at follow-up	18.0	27.8	36.2	63.9
Percent with impaired adjustment at follow-up	41.3	50.0	61.0	77.2
Percent with illness more severe than mild psychoneurosis (including pathologic personality)	29.0	39.5	45.9	74.7
Percent drawing no disability compensation	47.7	56.8	52.1	51.8
Percent with poor prognosis	17.1	25.9	33.6	64.3

2. *Relation to preservice impairment and adjustment.* The above measures of follow-up status were also related to preservice impairment and adjustment. The latter were found to be significantly associated with psychiatric disability and prognosis at follow-up, especially preservice impairment, but not to any greater degree than preservice personality. Somewhat similar findings were obtained when adjustment and psychiatric diagnosis at follow-up were compared with preservice impairment and adjustment. Disability compensation seems unrelated to either preservice impairment or adjustment (tables 7 and 8).

TABLE 8. *Follow-up status of preservice adjustment groups*

Follow-up status	Satisfactory	Questionable	Impaired
Percent with at least moderate disability at follow-up	10.7	26.2	38.7
Percent with impaired adjustment at follow-up	23.5	42.9	66.7
Percent with illness more severe than mild psychoneurosis (including pathologic personality)	16.7	32.2	53.0
Percent drawing no disability compensation	40.7	51.6	52.6
Percent with poor prognosis	9.5	17.8	38.7

3. *Effect of type of disposition (medical or nonmedical) on follow-up status.* An attempt was made to determine whether the type of disposition per se had any effect on the course of illness after discharge. Two disposition groups were established, one for disability discharges and the other for men returned to duty. These were then matched on the following characteristics: (a) severity of first illness in service; (b) pre-service personality and impairment; and (c) major area of stress causing breakdown. This possibility was explored because of the hypothesis that a man who is discharged via medical channels as disabled may have to contend with the psychologic factor of being considered sick (including the temptation of secondary gain of illness) and therefore may not do as well as a similar man who is returned to duty and later discharged administratively. The results of studying groups which were matched only for the above characteristics left many other variables, such as condition on discharge and treatment since discharge, uncontrolled and the results were consequently only suggestive.

The men who were discharged for disability were somewhat more disabled at follow-up than those who were returned to duty and later discharged for the convenience of the government, but statistically the findings were suggestive rather than significant. The two groups differed significantly as to psychiatric diagnosis at follow-up, those returned to duty having a clear advantage (table 9). If a man were returned to duty without subsequent medical discharge, his chances of not being ill at follow-up appear to be about twice as great as one who was medically discharged on psychiatric grounds. It was also found that those

who were medically discharged were much more apt to receive disability compensation, but this fact does not in itself indicate that these men were any sicker on follow-up. As suggested above, it may be that those who were medically discharged were the ones who did not improve with treatment after their breakdown and consequently were sicker when they were discharged, emotionally sicker on follow-up (though not significantly more disabled), and therefore received compensation much more frequently. Medical discharge in itself may have been a factor and further study of the problem is indicated.

TABLE 9. *Percentage distribution of patients by diagnosis at follow-up for two groups differing as to disposition from hospital but matched on other determinants\* of prognosis*

Psychiatric diagnosis at follow-up	Disposition from hospital	
	Duty (150 men)	Medical discharge on psychiatric grounds (162 men)
Not ill	41	19
Psychoneurosis, mild	31	39
Psychoneurosis, moderate	13	27
Psychoneurosis, severe	4	4
Other (personality disorder, psychotic reaction, et cetera)	11	11
Total	100	100

\*Determinants chosen were severity of illness in service, preservice personality, preservice impairment, and major area of precipitating stress.

#### *Effect of treatment in the service*

In order to study the effect of treatment received after breakdown, treatment groups were matched on the basis of preservice personality, preservice impairment, severity of first illness in the service, and type of precipitating stress. The type of treatment (hospital routine, individual therapy, and essentially none) was then correlated with ultimate disposition (certificate of discharge for disability or duty), the quality of any subsequent duty, emotional health on separation from the service, and follow-up status. Within this framework the type of treatment in service had no demonstrable effect on any of the indexes of subsequent performance or health status in the service and at follow-up. This does not necessarily mean that treatment had no effect. It suggests that there was little or no difference in the effects of the various types of treatment or that the groups were inadequately matched.

#### DISCUSSION

*Induction policy.* In the early period of mobilization for the last war, it was hoped that the psychiatric problem of World War I could be avoided by careful screening at induction and the elimination of those

with emotional difficulties. Despite high rejection rates for psychiatric disorders, large numbers of men with emotional difficulties of all severities kept turning up. At first the policy was to discharge them, but as the discharges increased the incidence of such disorders also seemed to increase. Later in the war, when there was a serious threat of manpower shortage (1) the standards for induction were lowered, (2) some men were taken in who previously would have been discharged, and (3) serious efforts were made to use limited service as well as general service personnel as effectively as possible. At times men with neurotic disorders could not be sent overseas; at other times they were.

Combat experience showed fairly consistently that for every 5 men wounded there would be about 1 psychiatric casualty. Men who had seemed well-adjusted emotionally broke down under the stress of combat and others who were known to have neurotic disorders did well. It seemed fairly clear that, except in obviously severe cases, reliable prediction concerning any one man's performance was not possible. The importance of such things as training, leadership, motivation, suitable assignment, and expectation of relief was recognized in relation to a man's ability to withstand emotional stress. This observation contributed to the establishment of a different concept of induction than existed at the beginning of the war: that only those men with neuroses which were already grossly incapacitating should be excluded and the remainder inducted. Only those who clearly demonstrated an inability to adjust in the service would be discharged. This policy is still in effect.

Our findings seem to support such a policy, for a large of total mobilization. Although not designed to contribute to such military problems as induction, utilization of manpower, and disposition of men hospitalized for psychoneuroses, the study does permit limited general conclusions to be drawn in these areas. The principal limitations of the study in this regard are:

1. All of the men in the sample were treated for psychoneuroses in the service. Conclusions which would be applicable to men presenting themselves for induction or to the general Army population are necessarily indirect.
2. The findings must be considered in relation to utilization and discharge policies which existed in World War II. It is not possible to state with certainty what effect other policies might have had.
3. Data on military performance were gathered from the standpoint of correlation with follow-up status. No explicit attempt was made to assess total military effectiveness as such.

Whereas in many criteria of military effectiveness those who were overtly neurotic prior to entering the service did poorly when compared to those who broke down but had been previously well-integrated, the neurotic group was by no means a total loss. It is true that all of these

men passed through an induction screening and as such were probably not as sick as, or were differently motivated from, others with overt neuroses who were rejected. Had there been no elimination of men with overt neuroses at induction, the percentage of such men in our sample would undoubtedly have been higher and the general military performance of the sample poorer, but it must be remembered that all men with pre-existing neuroses did not break down in the service. If it is postulated that only 50 percent of them did, and if the performance of those who did not break down could be averaged in with the sample studied, it would be seen that overt neurotics generally did much better than those included in this study sample.

Thirty-two percent of the neurotic group were able to complete their training and serve overseas for an average of 17 months before breakdown. In 18 percent, breakdown was the result of combat stress. Thirty percent completed their military service and were demobilized (without being medically discharged for psychoneuroses). There is no test which can equal actual trial at duty in differentiating those with good from those with poor prognoses, especially since one man may do well in one situation with a given commanding officer and branch of service and do poorly in another, whereas it might be just the reverse with another man. The performance of those with suggestive neuroses and neurotic traits on entry into the service was much better, with the latter group in some respects approximating the normal group.

The proportion of men in the service with pathologic personalities and suggestive neuroses who broke down is perhaps 15 to 25 percent smaller than that of the neurotic group so that the extent to which our figures are biased by confinement to just those who broke down can be seen. Any attempt to eliminate at induction all men with neuroses or pathologic personalities would be extremely wasteful, even if possible.

If it is assumed that all of the men who broke down were not induction errors (and this cannot be the case because the sample consisted of men with all gradations of emotional stability), then the problem of induction standards can be approached via this question: "What increase in the rigidity of psychiatric standards could have minimized the rate of breakdown in the service?" If the entire Army population during the war (about 12,000,000 men) could have been classified as to preservice personality, as was done with our sample, some such breakdown as is shown in table 10 might have resulted.

If, on the basis of the distribution of our sample, the 600,000 different men who were admitted one or more times for psychoneuroses during the war were classified as to preservice personality, the results shown in table 11 would have been obtained.

In order to eliminate those with suggestive and overt neuroses and those with pathologic personalities, who made up about 50 percent of all those who broke down, it would have been necessary to eliminate

TABLE 10. Possible preservice personality figures for entire Army population

Preservice personality	Frequency distribution	
	Number	Percent
Well-integrated	7,800,000	65
Neurotic traits	2,760,000	23
Suggestive neuroses	360,000	3
Overt neuroses	120,000	1
Pathologic personalities	480,000	4
Other types of disorders	480,000	4
Total	12,000,000	100

about 1,000,000 or one-twelfth of the Army. This would be in addition to all of those who were rejected at induction and theoretically would reduce the psychiatric problem by only one-half.

*Utilization and discharge policy.* For each man in the sample, the emotional health on discharge from the service was assessed on the basis of his military medical records, his own statements, the course of his illness since discharge, and his condition on follow-up examination. Seven percent were evaluated as normal on discharge, 8 percent had neurotic symptoms short of an actual neurosis, and 55 percent had neuroses which were not severe. This gives a total of about 70 percent who had less than severe neuroses on discharge. About 10 percent had various organic illnesses and behavior disorders of varying degree of severity. Twenty percent were considered to have severe neuroses. This contrasts sharply with the 55 percent of the entire sample who received medical discharges for psychoneuroses.

TABLE 11. Possible preservice personality figures for patients admitted for psychoneurosis

Preservice personality	Frequency distribution	
	Number	Percent
Well-integrated	86,000	14.3
Neurotic traits	206,000	34.3
Suggestive neuroses	99,000	16.5
Overt neuroses	88,000	14.7
Pathologic personalities	121,000	20.2
Total	600,000	100.0

On follow-up, 7 percent of the entire sample were not working, and an additional 6 percent were working only part time, because of illness. The more severe the illness at follow-up, the higher the proportion of those whose ability to work was affected. In comparison with 13 percent for the entire sample, the percentages are 2 for those with a mild neurosis, 26 for those with moderate neurosis, and 79 percent for those with severe neurosis. If these percents are applied against the diagnostic breakdown of men discharged for disability at the time they left the service, it may be estimated that about 60 percent of the men who were discharged as incapable of performing any effective military service were able to work according to civilian standards.

The above evidence confirms the fact which became apparent during the last war that the use of limited capacity personnel has been deficient. For a time, in 1943, by War Department directive, limited service personnel (with but few exceptions) were medically discharged. Men were taken from jobs which they were performing satisfactorily and sent home. At the end of the war medical discharges were again encouraged in many instances because of lack of assignments and, in some instances, because of shortage of hospital beds. It was not unusual to induct men with psychiatric disorders for which others were being discharged. In any group of men inducted, regardless of the rigidity of the standards, a certain percent will be found unsuitable for general service from the start because of emotional disorders. As time goes on, particularly in wartime, there will be a gradual increase in the number of such men in the Army as a result of emotional disorders which develop in connection with the various stresses inherent in military life, the most obvious one being combat.

If the manpower pool were for practical purposes limitless, it would be possible to maintain a policy of using only those capable of general service and discharging the rest, but this is not the case, and limited as well as general service personnel must be used. Because it is conceivable that the exigencies of any given military situation may require limited service personnel to operate beyond their usual capacities (and even in combat), it would seem important to conserve such manpower. Once a man has been discharged from the service as medically disabled, the chance of his ever being used again by the military services is practically nil. Under a liberal discharge policy the natural forces which make men avoid danger drive more and more men in the direction of limited service and discharge.

The use of men with psychoneuroses is just one part of this problem, but the one with which we are here concerned. The results of this study would suggest that at least half of those in the sample who were medically discharged could have been used if proper assignments had been found for them. If about 250,000 men were discharged from the

Army for psychoneurosis during the last mobilization, it can be assumed from the above estimate that at least 125,000 were needlessly discharged as disabled. Apart from the loss of manpower that this entailed, and the effect on the morale of the Army, it is possible that the fact of a medical discharge carries with it certain liabilities to both the man and the country. A man who is discharged on psychiatric grounds appears to be twice as apt to be sicker on follow-up than an identical man who was returned to duty and eventually discharged for the convenience of the government. Also, if a man were returned to duty, the chances are 2.5 times as great that he will not be given any compensation.

In one experimental project of retaining psychoneurotics after breakdown in the last war, many were rehabilitated for assignments in the service branches in the zone of the interior and to a large extent the failures which resulted stemmed from inadequacies in the assignment process (5). It may not be possible to devise a system for using increasing numbers of limited service personnel within the framework of the Armed Forces. A system of universal mobilization in time of emergency might then provide the answer by permitting interchange between military and nonmilitary assignments. Certainly the disability discharge should not be used as an expedient to solve the problem of no assignment.

Once a man has lost time from duty for a psychoneurosis, are there any criteria to indicate his potential for further service, apart from usual clinical judgment, his response to treatment, et cetera? The fact that a man was overtly neurotic prior to induction is in itself important because only 6 percent of this group were able to render any effective service after having once been hospitalized. The possibility that insufficient effort was taken to find appropriate assignments for these men following return to duty is partially refuted by the finding that many men in the normal group who broke down were capable of effective service after breakdown. This would appear to indicate a better adjustment potential but many of these cases were the result of combat, so that a totally different military situation and different motivational forces were involved. Even if the adjustment potential of the neurotic group were generally poor, it is possible that through the use of a more careful assignment procedure many more than 6 percent would be capable of rendering effective service after breakdown. Only one of the 44 men who had overt neuroses prior to service and who claimed to have had at least moderate impairment in their ability to function before entering the service was capable of rendering good and continued service once having been hospitalized. Of 6 such men who, in addition, claimed that their health was poor on entering the service, none ever reached combat. It may be that in the last war such men were 'induction errors' and apart from them it does not seem possible to predict the subsequent performance of those who broke down.

(5) Menninger, W. C.: *Psychiatry in a Troubled World*. Macmillan Co., New York, N. Y., 1948, p. 313.

It is possible (and according to many psychiatrists even probable, particularly if the experience with combat cases is remembered) that the mere act of taking such a man off duty status and placing him in a hospital or other treatment facility in itself decreases to a large degree his chance of being effective again in the service. Some of the more severe cases will require hospitalization, but it was a common observation that, because of the absence of any other kind of facility, most of the psychoneurotics who were hospitalized in the service would not have been hospitalized for the same difficulty in civil life. In combat areas, barriers had to be set up to control the very great pressure to get into a hospital. In general no such system operated in the zone of the interior except where outpatient or mental hygiene clinics were established. Unless changes in the assignment and hospitalization systems can be made, it can be postulated that about 50 percent of those who are overtly neurotic before service and who get into the Armed Forces will be hospitalized after about 13 months of service and that, at that point, their military usefulness is for practical purposes over. Although many psychiatrists held such convictions, based on their impressions, this study gives these impressions statistical confirmation.

*Relationship between induction and utilization policies.* It is axiomatic that if criteria for induction are set up, they must be in relationship to something (6). The assumption is that they are related to the ability to perform military service. Elementary as this may be, experience has shown that this has not always been the case. Even at present, men are probably being inducted with conditions for which others are being discharged. Induction criteria presuppose the use of personnel with limited capacity whereas there is no such official policy. The question, "What are men being inducted for?" must be answered if (1) intelligent induction is to be planned, (2) wastage of manpower is to be avoided, (3) psychologic harm is to be prevented, and (4) unnecessary compensation burdens are to be avoided and confusion eliminated. Our study is not concerned with the problem of a small volunteer, peacetime army, such as existed between World War I and World War II. Recruitment standards were then geared to the number of men who were volunteering. In a period of economic depression, volunteers are plentiful and physical standards are raised, but in times of prosperity, fewer men volunteer and standards must be lowered if authorized strength is to be reached. Our study is concerned with mobilization—partial or complete—in which men are drafted into service. If an enlarged cadre-type of force is wanted—one that is composed entirely of general service men—rigid induction criteria must be established. To accomplish this under the draft would either involve the rejection of many men who could be of use or encourage conscious or unconscious flight into illness in many who feel the need to avoid military service.

(6) The factors of national morale and of productive capacity as they relate to induction policy have not been considered here.

## CONCLUSIONS

**Induction.** By World War II standards, the men in our sample who were overtly neurotic prior to service should have been rejected. Yet they made a significant contribution to the military effort, even in combat. To the extent that induction screening is directed at the procurement of men having the capacity for adequate military performance, a more rigorous psychiatric screening than prevailed in World War II offers no prospect of gain. This is because, in this study, a much more rigorous psychiatric examination than was given at induction still does not permit the discrimination, in advance, of a set of men whose military performance can be called submarginal. No conceivable induction psychiatric screening can eliminate more than about half of the admissions for neurosis, and the cost of so doing would be the rejection of about 10 percent of those accepted in World War II. Only 35 percent of the sample had an overt neurosis or a pathologic personality at induction. Another 17 percent had a suggestive neurosis. In the aggregate these 3 groups probably included about 1 million out of 12 million men in the Army. Criteria for judging adequacy of military performance seem lacking and it is believed that if marginal military performance were defined in terms of the man whose military contribution just exceeds the cost of training him, a large number of men excluded in World War II would be called useful in this limited sense. Other than narrowly military criteria are involved in the selection of manpower for military service and it is not asserted that these men should be taken, but only that, if a military force larger than that of World War II were required, additional men could be taken without reaching the marginal point of no return.

**Utilization.** However poor personnel utilization was in World War II, it sufficed to permit overt neurotics, admitted through error, to make a useful military contribution. The evidence of the study is, however, that there is ample room for improvement in personnel utilization. Because hospitalization per se aggravates the disability in many psychoneurotics (including the many with conditions which are mistakenly labeled as organic disease), the system of medical treatment in the Army which depends to such a great extent on hospitalization should be radically revised in the direction of outpatient treatment. Inasmuch as in any mobilization there will be a gradual increase in the number of limited service personnel, some policy should be worked out ahead of time for their use, rotation, or discharge by channels other than medical.

**Disposition.** The disposition policy must be closely articulated with the induction policy. In World War II this articulation was less than satisfactory. Many men were given a certificate of discharge for disability whose emotional health was no worse than that of men being inducted, and by civilian standards relatively few of the men in the sample were unable to work full time because of illness. This study suggests that the

fact of a medical discharge for psychoneurosis may itself impair ability to adjust in civil life. Comparison of two carefully matched groups, one discharged on points, the other for disability, reveals that more of the men in the latter group were ill at follow-up. Men who had a moderate to marked impairment with an overt neurosis at entry apparently were unable to make any effective military contribution after breakdown. The disposition policies of World War II would be impractical in a military situation requiring a much larger mobilization, since discharge for psychoneurosis would effectively bar subsequent military duty almost regardless of the extent of recovery. In a long-lasting conflict such men would be particularly needed.

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#### BOOK REVIEW

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**Immuno-Catalysis, And Related Fields of Bacteriology and Biochemistry**, by M. C. Sevag, Ph. D., Associate Professor, Department of Bacteriology, School of Medicine, University of Pennsylvania, Philadelphia, Pa., with a preface by Stuart Mudd, M. A., M. D., Professor of Bacteriology, School of Medicine, University of Pennsylvania, Philadelphia, Pa., 2d edition, revised and enlarged. 547 pages. Charles C Thomas, Publisher, Springfield, Ill., 1951. Price \$12.

This new edition of an excellent treatise on the interrelationships between the phenomena of immunity and biocatalysis has been enlarged to include a chapter on the physiology and biochemistry of shock. The immunologist and the enzymologist will welcome the manner in which the author has brought up to date the chapters on antibody formation, immune and enzyme reactions, antienzyme immunity, and problems of production of antibodies against respiratory enzymes. The presentation of the controversial aspects of the problem has only in a few instances been biased by the author's own research; particularly is this true in the aspects of immunochemistry and infectious disease. The chapter on shock consists of a survey of the physiologic changes accompanying the various types of shock and is followed by a discussion of histamine, acetylcholine, and tissue proteolytic enzymes that are believed to be the specific factors responsible for the reactions occurring in shock. The book is highly recommended to the specialists in immunity and enzymes and to the biochemist trained in bacteriology and immunology. It is a valuable reference book for the experimental pathologist but is not recommended to the clinician.—Maj. E. M. Parrott, MSC, U. S. A.

## BOOK REVIEWS

**Primary Anatomy**, by H. A. Cates, M. B., Professor of Anatomy and Director of the School of Physical and Health Education, University of Toronto. 2d edition. 344 pages; illustrated. The Williams & Wilkins Co., Baltimore, Md., publishers, 1951.

This is the second edition of a textbook on anatomy which was primarily designed for nonmedical students who need a basic knowledge of anatomy. The large standard text of anatomy would be superfluous to the needs of students of nursing, public health, physiotherapy, et cetera. This volume is printed in two columns and contains many illustrations, designed in some instances to show the physiologic function of the structure discussed. The finer points of anatomic relationship are not fully covered but this in no way detracts from the purpose for which the book was written. The author has briefly described the development of the various systems. In many instances the practical application of the anatomic structure is discussed, adding to the interest of the subject. This book could well be used by pre-medical students and the many fine illustrations constitute an excellent visual aid in teaching anatomy to medical corpsmen, first aid students, physiotherapists, and health educators.

—Lt. Col. M. E. Groover, Jr., U. S. A. F. (MC)

**Poisons, Their Isolation and Identification**, by Frank Bamford, B. Sc., Late Director of the Medico-Legal Laboratory, Cairo. Revised by G. P. Stewart, D. Sc., Ph. D., Reader in Chemical Chemistry, University of Edinburgh; Senior Biochemist, Royal Infirmary, Edinburgh; with a foreword by Sir Sydney Smith, C. B. E., F. R. C. P., Regius Professor of Forensic Medicine, University of Edinburgh. 3d edition. 316 pages, 22 illustrations. The Blakiston Co., Philadelphia, Pa., publishers, 1951. Price \$5.50.

This volume is essentially a compendium of methods found useful for the identification of toxic agents encountered in a chemical laboratory devoted to medicolegal problems. The coverage of the work is indicated by its chapter headings: Classes of Poisons, Volatile Poisons, Metallic Poisons, Corrosive Acids and Alkalies, Organic Poisons, Alkaloids, et cetera. Each chapter indicates the general symptoms, preliminary micro tests, methods of sampling, and quantitative determination of the toxic agent. The text will be useful to those who wish to have readily available tested methods for the identification of poisons. Its comprehensive coverage is unequalled in any similar volume which has come to my attention. It is recommended as a reference for medical libraries, as well as a laboratory manual for an advance course of study in forensic chemistry.—Commander H. C. Dudley, MSC, U. S. N.

# Frostbite in Korean Casualties<sup>(1)</sup>

Luther G. Bell, Captain, MC, U. S. N.

LeRoy H. Stahlgren, Lieutenant, junior grade, MC, U. S. N. R.

Bernard D. Sherer, Lieutenant, MC, U. S. N.

**F**ROSTBITE has been a major medical problem in military campaigns throughout recorded history and has included a variety of poorly understood clinical entities for which many therapeutic measures have been tried. Despite the fact that over 60,000 such cases were reported in World War II, experiences with a large group of frostbite victims indicate a general need for a wider acquaintance with this syndrome. Larrey's (2) account of cold injuries, as observed while serving as Surgeon General to Napoleon's armies during the retreat from Moscow, is the first modern writing on the subject. In the Crimean War cold, muddy trenches were thought to be the cause of painful feet among the soldiers (3). The "trench-foot" syndrome observed during World War I was described by Greene (4) and others. World War II introduced similar types of cold injuries, named after the manner in which they occurred, such as "immersion foot" (5-7), "shelter foot" (8), and high altitude frostbite (9).

In 1900, Rischpler (10) recorded the microscopic changes that occur as animal tissue is frozen and particularly commented on the degenera-

(1) U. S. Naval Hospital, Philadelphia, Pa.

(2) Larrey, D. J.: *Mémoires de Chirurgie Militaire, et campagnes*. C. J. Smith, 1812. Vol. 3, Paris; p. 60.

(3) *Medical and Surgical history of the British Army which served in Turkey and the Crimea during the war against Russia in the Years 1854-1856*. London, 1858. Vol. 2, p. 187.

(4) Greene, R.: Frostbite and related ills. *Lancet* 2: 689-693, Dec. 6, 1941.

(5) Webster, D. R.; Woolhouse, F. M., and Johnston, J. L.: Immersion foot. *J. Bone & Joint Surg.* 24: 785-794, Oct. 1942.

(6) White, J. C., and Scoville, W. B.: Trench foot and immersion foot. *New England J. Med.* 232: 415-422, Apr. 12, 1945.

(7) White, J. C.: Vascular and neurologic lesions in survivors of shipwreck; Immersion-foot syndrome following exposure to cold. *New England J. Med.* 228: 213-222, Feb. 18, 1943.

(8) Knight, R. T.: "Trenchfoot" in civilians. *Brit. M. J.* 2: 610, 1940.

(9) Davis, L.; Scarff, J. E.; Rogers, N.; and Dickinson, M.: High altitude frostbite; preliminary report. *Surg., Gynec., & Obst.* 77: 561-575, Dec. 1943.

(10) Rischpler: Cited by White and Scoville (6).

tion and vacuolation of cells in blood vessel walls. Investigations of trench foot in World War I by Smith et al. (11) was the first actual reproduction of cold injuries in experimental animals under conditions simulating those seen clinically. They produced trench foot in rabbits by exposing them to cold but not necessarily freezing temperatures and observed the tissue response, which they noted was typical of subacute inflammation. The inflammatory response was aggravated by circulatory embarrassment, the presence of moisture, and rapid warming of the part.

Lewis (12-14) helped to clarify the changes by properly emphasizing the importance of damage to the most peripheral components of the vascular bed. He pictured the initial vasoconstriction, which was both peripheral and central in origin, as the cause of local ischemia resulting in cellular degeneration and release of a histaminelike substance. These factors produced increased capillary permeability and vasodilatation resulting in a "flooding" of the part with tissue edema. This fairly typical inflammatory response reached its height in about 3 days and then gradually subsided in 2 weeks, depending on the intensity, duration, type of exposure, and individual reaction or susceptibility. During the period when the inflammatory response was acute and the tissue edema pronounced, the pulses were bounding and the part warm, masking the damaging cellular anoxia which persisted. As a result of these processes peripheral clotting occurred which further embarrassed the delivery of oxygenated blood to the most distal vascular bed.

Lempke and Shumacker (15) further clarified the basic physiologic and pathologic changes in cold injuries by stressing the primary injurious effect of cold on ischemic tissues and the resultant "obliteration of the arterial tree by thrombosis." They produced frostbite in the tails of mice and then tried several methods of treatment using fairly adequate controls. Because agents producing vasodilatation (such as the tetraethylammonium ion) and inhibiting coagulation (such as heparin) caused a decrease in the loss of tissue, the authors concluded that the pathologic changes which these agents minimize are important in the functional pathology of frostbite.

(11) Smith, J. L., Ritchie, J., and Dawson, J.: Clinical and experimental observations on pathology of trench frostbite. *J. Path. & Bact.* 20: 159, 1915.

(12) Lewis, T.: Observations on some normal and injurious effects of cold upon the skin and underlying tissues, reactions to cold, and injury to normal skin (Holme lecture). *Brit. M. J.* 2: 795-797, Dec. 6, 1941.

(13) Lewis, T.: Observations on some normal and injurious effects of cold upon skin and underlying tissues, chilblains and allied conditions (Holme lecture). *Brit. M. J.* 2: 837-839, Dec. 13, 1941.

(14) Lewis, T.: Observations on some normal and injurious effects of cold upon skin and underlying tissues, frost-bite (Holme lecture). *Brit. M. J.* 2: 869-871, Dec. 20, 1941.

(15) Lempke, R. E., and Shumacker, H. B., Jr.: Studies in experimental frostbite, evaluation of several methods for early treatment. *Yale J. Biol. & Med.* 21: 321-334, Mar. 1949.

Lange et al. (16) followed the physiologic changes in frostbitten rabbit legs by means of iotrvavenous fluorescein which appeared in the extremities at the time of the vascular engorgement but did not appear when the test was repeated from 2 to 12 days later after capillary thrombosis had occurred. By demonstrating the effectiveness of heparin in human volunteers they believed that they had incriminated capillary clotting as an important factor in the process of frostbite. The available experimental data indicate the importance of initial cellular damage due to cold and local ischemia caused by thrombosis in the most peripheral vessels in patients with cold injury.

#### DESCRIPTION OF CASES

The 150 patients here reported were taken from a group of 175 casualties removed from the Korean theater during and immediately following the dramatic retreat from the reservoirs. On transfer to this hospital they were admitted to one of three wards, depending on the severity of their lesions. During the course of treatment each was classified according to the degree of frostbite sustained. First degree implied loss of superficial dermal layers (peeling); second degree, loss of the full thickness of the skin and superficial subcutaneous tissue; third degree, loss of deep subcutaneous tissue and distal parts; and fourth degree, major tissue loss including bone. These victims, whose average age was 21 years, were for the most part dressed comfortably for cold weather. Footgear consisted of waterproof rubber boots with removable inner soles. Over 75 percent wore two pairs of woolen socks and most of the remainder wore two woolen pairs and one cotton pair. The enemy attacked with overwhelming force toward the end of November 1950 under extreme climatic conditions. Temperatures ranged between -20° and -30° F. and were lower in certain sectors. The retreating marines were forced to fight their way toward the coast under these adverse conditions with few fires, no warming tents, and no warm food. With an understanding of this basis of physical exhaustion, the precipitating causes of frostbite in these patients will be described.

#### CAUSATIVE FACTORS

Constantly wet skin bears an increased susceptibility to cold because of its greater conductivity. Over 60 percent of the victims were frostbitten while pinned down by enemy fire after a long march. They were forced into cramped positions in foxholes where they remained inactive with their feet lying in snow and their socks wet from perspiration. Proper foot care (change intm dry socks, massage, warming with body heat) before the wet footwear froze would have prevented or lessened the severity of the frostbite, but there was rarely time for such measures. The average length of time between changes of socks was 4½ days and in many cases over 10 days. Of the remaining 40 percent, 10 percent had been wading in icy water before being frostbitten. The

(16) Lange, K.; Weiner, D.; and Boyd, L. J.: Frostbite; physiology, pathology and therapy. New England J. Med. 237: 383-387, Sept. 11, 1947.

## DEGREE AND LOCATION OF INJURY

All injuries were at least second degree. The parts injured are shown in table 3. In one patient one elbow, one knee, one ear, and the penis suffered frostbite. Increased severity in one limb was not seen except in patients with a wound or previous trauma to the frostbitten part.

TABLE 3. *Parts injured in 150 patients with cold injury*

Part	Percent
Fingers and toes	63
Limited to feet	27
Limited to toes	8
Limited to fingers	2
Nose	3

## INITIAL TREATMENT

Five percent reported that they had been treated immediately. The time elapsing between recognition of frostbite and treatment in the remainder ranged from a few hours to 21 days (average 5½ days). Each patient was questioned carefully about the treatment given including medication, advice, and operative procedures. Those who were uncertain about important aspects of their care were omitted from this report. Even though such an approach must result in some inaccuracies, the results may at least serve as a general indication of the treatment given. (table 4). Most of the bed patients were ambulatory at intervals for toilet, meals, et cetera. Fourteen percent stated that their feet were

TABLE 4. *Treatment given to 150 patients with cold injury*

Treatment	Percent
Bed rest	72
Instructions	
No smoking	68
No coffee	30
Antibiotics	
Penicillin	34
Aureomycin	2
Heat	25
Dicumarol	3
Vitamins	2
Vasodilators	
Blocks	1
Procaine, given intravenously	3
Whiskey	10
No treatment	6

elevated while reclining. Most of the wounded received morphine and other opiates as would be expected. The relations of these drugs to frostbite has not been determined.

#### LATE TREATMENT

All patients with (1) infected wounds; (2) incompletely separated gangrenous parts; (3) incompletely epithelized denuded, areas; and (4) excessively painful areas were not allowed to bear weight on the injured part. Complete bed rest for some of these otherwise healthy young men, many of whom were discouraged by the long convalescence, was difficult to enforce, but we believed that noticeable benefit was derived from thus decreasing the trauma to the affected part. Laxity in following the order was frequently followed by a flare-up of secondary infection at the level of demarcation of healthy tissue. In the presence of open or demarcating lesions, the injured parts were kept elevated.

Conservative and careful débridement of dead tissue was practiced daily to insure adequate drainage. In patients with weeping, gangrenous, and painful wounds electric fans were directed toward the area to increase comfort and to decrease maceration of questionably viable tissue. Intermittent soaks in tepid water or saline solution (sterile if wounds were open) were prescribed to cleanse open wounds and to hasten the process of demarcation of viable and nonviable tissue. The latter was also accomplished by wrapping with wet dressings and then covering the whole with cellophane or oilcloth. No strong antiseptics were applied.

Antibiotics were used only in the presence of secondary infection as evidenced by fever, toxemia, and local signs of inflammation. Penicillin was the agent of choice, but if progress was not satisfactory in 2 days, aureomycin was added. There were no serious complications from infection. Symptomatic relief was not a great problem, but in a few patients with persistent painful paresthesias and excessive perspiration the first 3 lumbar ganglia were blocked with fair results. No sympathectomies were performed. We believed that intermittent soaks with elevation of the part produced the most effective relief. Opiates were almost never given because of the chronic nature of the complaints.

About 5 percent of the wounds were suitable for grafting. Those few lesions with healthy, clean granulations were covered with split thickness grafts to speed healing. These have not been followed long enough to evaluate the results properly.

Physical therapy in the form of whirlpool baths, joint motion, and correction of contractures and muscle weaknesses was helpful. Occupational therapy was of inestimable value in keeping the minds and fingers of many of these restless patients busy.

## RESULTS

The interval since discharge has been too short to allow evaluation of the results of treatment except by recording the loss of tissue. Of the 150 patients, a significant amount of tissue was lost in 18 (12 percent). These include 3 bilateral below-knee amputations and 1 bilateral Syme amputation. The remaining 14 patients lost phalanges or whole digits. Smaller amounts of tissue loss such as tips of fingers, toes, and areas on heels and sides of feet were not included because these healed without noticeable deformity.

## CONCLUSIONS

Important factors in the high incidence and severity of frostbite among our forces during a 12-day retreat were: (1) impending physical exhaustion; (2) skin constantly wet because of excessive perspiration within waterproof boots and inadequate foot care; (3) local ischemia resulting from vasoconstriction and circulatory stasis; and (4) delay in recognition and treatment. Nearly 50 percent of the 150 patients studied experienced no symptomatic evidence of frostbite. These were detected by inspection which revealed discoloration, painless blisters, or swelling of the part. Residual symptoms were not incapacitating but were present in 95 percent of the series. Hyperhidrosis and paresthesias in response to temperature changes were the most common of these. Initial treatment was begun an average of 5½ days after frostbite was incurred. Because of the conditions under which the injuries occurred, early treatment was inadequate. Late treatment consisted of complete bed rest with elevation of the injured part, conservative daily débridement, and intermittent saline soaks. Wet dressings, antibiotics, paravertebral blocks, and grafting were used. No attempt at early operative treatment was made. Eighteen patients (12 percent) suffered significant loss of tissue. Four of these required major amputations.

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# An Epidemic of Rheumatic Fever in Japan and South Korea<sup>(1)</sup>

Robert E. Blount, Colonel, MC, U. S. A.

James A. Orbison, Lieutenant Colonel, MC, U. S. A.

Arthur P. Long, Colonel, MC, U. S. A.

George N. Schuhmann, M. D.

DURING mobilization and under conditions leading to crowding, exposure, and fatigue, hemolytic streptococcal infections may present problems of grave import in military medicine. The acute streptococcal respiratory infections have been important not only because of the high noneffective rate noted in epidemics, but also because of the crippling effects of such late nonsuppurative complications as rheumatic fever and acute glomerulonephritis (2-9).

In 1946 several outbreaks of beta hemolytic streptococcal respiratory infections were observed at training centers throughout the United States. Type 17 streptococci were identified as the responsible patho-

(1) Read at Maryland, District of Columbia Regional Meeting of the American College of Physicians, Washington, D. C., 17 February 1951.

(2) Paul, J. R., et al.: The Epidemiology of Rheumatic Fever and Some of Its Public Health Aspects. 2d edition. Printed for the American Heart Association by the Metropolitan Life Insurance Co., 1943.

(3) Hedley, O. F.: Rheumatic heart disease in Philadelphia hospitals, study of 4,653 cases of rheumatic heart disease, rheumatic fever, Sydenham's chorea, and subacute bacterial endocarditis involving 3,921 admissions to Philadelphia hospitals from January 1, 1930 to December 31, 1934; age, race, and sex distribution and interrelation of rheumatic fever, Sydenham's chorea, rheumatic heart disease, and subacute bacterial endocarditis. Pub. Health Rep. 55: 1647-1691, Sept. 13, 1940.

(4) Griffith, G. C.: Rheumatic fever; its recognition and treatment. J. A. M. A. 133: 974-981, Apr. 5, 1947.

(5) Paul, J. R.: Epidemiology of rheumatic fever. Am. J. Med. 2: 65-75, Jan. 1947.

(6) Swift, H. F.: Relationship of streptococcal infections to rheumatic fever. Am. J. Med. 2: 168-189, Feb. 1947.

(7) Swift, H. F.: Etiology of rheumatic fever. Ann. Int. Med. 31: 715-738, Nov. 1949.

(8) Kerr, W. J.: Pathogenesis of rheumatic fever. Ann. Int. Med. 29: 587-594, Oct. 1948.

(9) Rantz, L. A.; Boisvert, P. J.; and Spink, W. W.: Etiology and pathogenesis of rheumatic fever. Arch. Int. Med. 76: 131-138, Sept. 1945.

gens in three centers, whereas in others, type 19 seemed to be implicated. In World War II, infections due to sulfonamide-resistant strains of group A streptococci were prevalent. One example may be cited in which 89 percent of the type 17 cultures isolated were resistant to blood levels of 5 mg. of sulfadiazine per 100 cc. (10). Most instances of such resistance were probably related to large-scale experiments in the control of respiratory infections with sulfonamides such as those conducted by the Air Force and Navy (7, 10). Carriers of resistant strains may have introduced organisms into susceptible populations not previously exposed to sulfonamide prophylaxis. One such circumstance was encountered at Keesler Air Force Base, Biloxi, Miss., where an outbreak of streptococcal infection occurred. This infection was believed to have been introduced by an inductee from California. Although the isolated organism (type 17 streptococcus) was sulfonamide-resistant but penicillin-sensitive, neither the carrier nor the affected troops had received sulfonamides (11).

The low troop strength of the Army of Occupation in Japan and Korea in the fall of 1946 created a military necessity of some gravity which required that personnel be rushed to these areas. Available replacements consisted largely of young unseasoned recruits and during the period from December 1946 to February 1947 nearly 60,000 of these men were sent by troopship from Seattle and San Francisco to Japan and Korea. Although the directness of the great circle route was logically desirable, its use was attended by cold, bad weather and rough seas. As a result, the troops remained in crowded compartments most of the time during the 11- to 14-day trip. Streptococcal tonsillitis, pharyngitis, and scarlet fever became prevalent on the troop transports and throat cultures taken at Inchon, Korea, on 15 January 1947 indicated that about 50 percent of the troops debarking from one transport were carriers of beta hemolytic streptococci. About 15 percent of the troops were ill on arrival and required hospitalization. At the same time, replacements were arriving in large numbers at Guam, the Philippines, the Ryukyus and Bonin Islands. These islands all have tropical or subtropical climates. Troopships to these sites followed the Southern route where the weather was warm, permitting troops to spend much time on deck. No outbreak of streptococcal infections or rheumatic fever occurred in these commands.

The critically strained housing facilities in both Japan and Korea rapidly became overcrowded, particularly at the replacement depots. As a consequence, many soldiers who were streptococcal carriers were released to the various divisional and nondivisional units throughout Japan and Korea. Although working quarantine was attempted,

(10) Coburn, A. F., and Young, D. C. Epidemiology of Hemolytic Streptococcus During World War II in the U. S. Navy. Williams & Wilkins, Baltimore, Md., 1949.

(11) Mitchell, P. B., and van Renswoude, A. C. Infectious diseases, hemolytic streptococcal diseases and acute rheumatic fever in AAF. Air Surgeon's Bull. 2: 311-314, Sept. 1945.

it was the experience of one of us in Korea that this expedient, while of value, did not prevent an alarming increase in the upper respiratory infection rate. The rate of clinical infection with hemolytic streptococci in Japan and Korea was not accurately known, but an estimated occur-

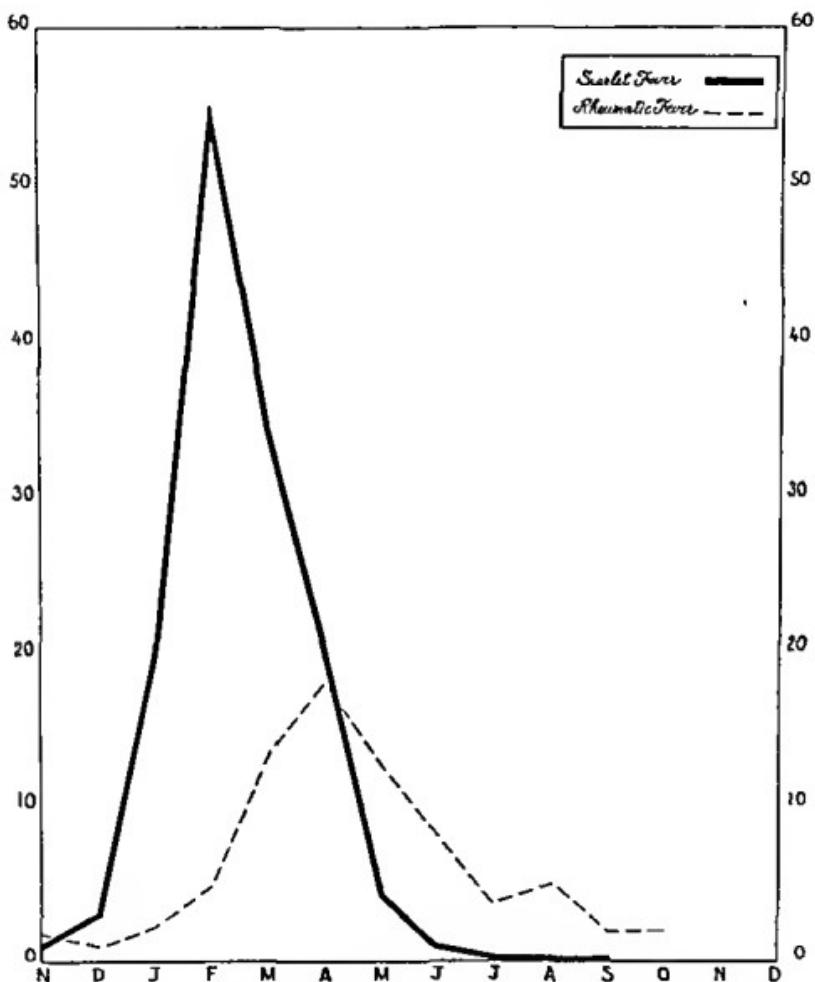


Figure 1. Incidence of scarlet fever and rheumatic fever (per thousand per annum) in Japan and Korea, November 1946 to October 1947.

rence of about 38,000 cases among a troop population of roughly 209,000 constituted an epidemic of significant proportions. Hemolytic streptococcal infections accompanied by punctate erythematous eruptions were readily recognizable and reportable as scarlet fever. A total of 2,237 patients with this entity were reported during the period from December 1946 to June 1947 with a sharp peak incidence of 54 per thousand per

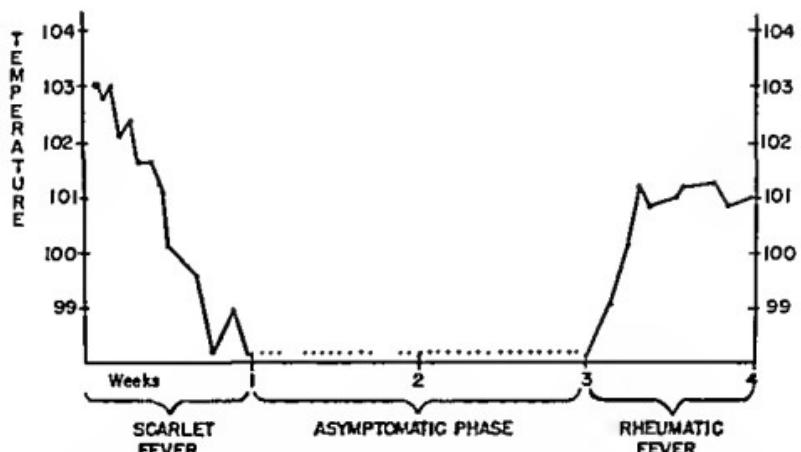
annum in February (fig. 1). It was believed that even these figures were conservative. Strict adherence to quarantine regulations relative to scarlet fever would have resulted in entire hospitals being filled for many weeks. It would have been inconsistent to isolate one form of streptococcal disease, and not others, simply because of a difference in nomenclature. Since it was not feasible to isolate all such patients for prolonged periods, scarlet fever was reported in many instances as streptococcal pharyngitis with secondary toxic erythema and not as scarlet fever.

The prophylactic and therapeutic ineffectiveness of sulfadiazine observed early aboard the troopships was soon appreciated in Japan and Southern Korea. Although penicillin was effective in controlling the acute manifestations and in hastening recovery, its use was limited by availability. Later, as supplies became more plentiful, the use of this drug in single daily doses of 300,000 units parenterally was found to be effective in preventing additional cases in some organizations (12).

Beta hemolytic streptococci were cultured from hundreds of patients, but unfortunately no actual typing was done nor were sulfonamide or penicillin sensitivity studies performed. On the other hand it was clinically demonstrable that the beta hemolytic streptococci responsible for the outbreak were probably resistant to sulfadiazine. The responsible organism, in most cases, was either a type 17 or type 19 Lancefield group A relatively sulfonamide-resistant streptococcus.

The clinical manifestations of the streptococcal respiratory infections were of variable severity and characterized in the typical case by a sudden onset. The symptoms commonly encountered included chilly sensations, fever, generalized aching, and sore throat accompanied by slightly painful deglutition. Redness and edema of the pharynx with associated patchy or diffuse exudates were frequent findings. Regional lymphadenitis of variable tenderness and severity was almost constantly observed in the moderate or more severe cases. Leukocytosis of moderate degree was usually demonstrable and throat cultures, when these were taken, showed a predominance of beta hemolytic streptococci.

The suppurative complications encountered usually responded readily to penicillin. Nonsuppurative sequelae, on the other hand, constituted a more serious problem. During recovery and following an asymptomatic period of about 2 weeks, some patients developed these nonsuppurative complications (fig. 2). Although streptococcal fever occurred in a large number of patients, acute glomerulonephritis in a few, acute rheumatic fever appeared in epidemic proportions. The relation of the preceding streptococcal infection to this outbreak is shown in figure 1.



*Figure 2. Sequence of events in a typical patient with a streptococcal infection followed by a nonsuppurative complication.*

Although the fact that scarlet fever is a reportable disease made it useful as an indicator of this relationship, it was readily apparent that other forms of streptococcal disease were equally important. Even mild, clinically inapparent infections have evidently been rheumato-generative (13-16) and it seemed likely that the second smaller increase in the incidence of rheumatic fever shown in figure 1 was caused by infections of this type.

Criteria used for the diagnosis of rheumatic fever were those of Jones (17) and are shown in table 1.

A total of 1,146 cases of rheumatic fever was recognized in U. S. Army troops in this outbreak in Japan and South Korea from December 1946 to May 1947. Most of these were evacuated to the zone of the interior as soon as they were transportable. Of this group, 275 patients were studied at the Oliver General Hospital; 15 percent of these gave a history of having developed scarlet fever shortly before the onset of the rheumatic fever; 88 percent stated they had noted a respiratory

(13) Rantz, L. A.; Spink, W. W.; and Boisvert, P. J.: Hemolytic streptococcus sore throat, detailed study of simultaneous infection of large number of men by single type. *Arch. Int. Med.* 76: 278-283, Nov.-Dec. 1945.

(14) Commission on Acute Respiratory Diseases: Study of food-borne epidemic of tonsillitis and pharyngitis due to B-hemolytic streptococcus, type 5. *Bull. Johns Hopkins Hosp.* 77: 143-210, Sept. 1945.

(15) Rantz, L. A.: Natural history of hemolytic streptococcus sore throat. California. *Med.* 65: 265-270, Dec. 1946.

(16) Kuttner, A. G., and Krumwiede, E.: Observations on effect of streptococcal upper respiratory infections on rheumatic children. 3-year study. *J. Clin. Investigation* 20: 273-287, May 1941.

(17) Jones, T. D.: Diagnosis of rheumatic fever. *J. A. M. A.* 126: 481-484, Oct. 21, 1944.

infection a few weeks preceding the appearance of the acute rheumatic fever; and only 10 percent gave a history of previous rheumatic fever. Thirty-three percent of the 275 patients studied showed evidence of carditis at some time or other during their illness.

TABLE 1. Criteria for diagnosis of rheumatic fever

Major manifestations	Minor manifestations
Carditis	Fever
Arthralgia.	Erythema marginatum (almost a major manifestation) or erythema multiforme.
Authenticated history of previous attacks of rheumatic fever	Abdominal pain
Subcutaneous nodules.	Precordial pains, especially in a young person.
Chorea (Sydenham type)	Repeated nontraumatic nosebleed
	Pneumonitis with or without pleurisy
	Laboratory evidence:
	1. Increased sedimentation rate
	2. Rising antistreptolysin titer.
	3. Leukocytosis which persists indefinitely.
	4. Macrocytic anemia

Confirming the observations of Griffith (4), we found the most helpful criteria in the diagnosis of rheumatic fever in young soldiers to be acute arthritis, evidence of carditis, fever, persistent elevation of sedimentation rate, and arthralgias. In young adults chorea, subcutaneous nodules, or epistaxis are rather rare manifestations of acute rheumatic fever.

Atypical manifestations (18) in young soldiers were not infrequent. These were: (1) absence of acute arthritis or arthralgia, (2) monarticular involvement, (3) absence of fever during the acute stage, (4) involvement of the small joints of the hands or feet, (5) onset with pleuritis, and (6) onset with pneumonitis.

Significant mitral systolic murmurs were not infrequent among the group who had manifestations of carditis. These characteristic mitral systolic murmurs often diminished as the carditis improved. Other patients showed either little change or, at times, definite increase in the intensity of the murmurs. Many of the patients with carditis developed aortic diastolic murmurs while under observation. In some, the aortic diastolic murmur diminished as the patient showed clinical improvement.

The differentiation of many of these cases from rheumatoid arthritis often proved to be difficult and time consuming. Cases of subacute rheumatoid arthritis were not infrequently tentatively diagnosed acute

(18) Sokolow, M., and Seidl, A. W. Atypical features of rheumatic fever in young adults. *J. A. M. A.* 133: 981-989, Apr. 5, 1947.

rheumatic fever. Careful clinical observation over a period of many weeks was often required to differentiate the two.

In addition to rheumatoid arthritis, the other conditions that were frequently considered in the differential diagnosis were: (1) gonorheal arthritis, (2) palindromic rheumatism, (3) infectious arthritis, (4) drug reactions, notably of the serum sickness type that sometimes follows penicillin therapy (especially penicillin in beeswax and peanut oil), (5) subacute bacterial endocarditis, and (6) lupus erythematosus disseminatus.

Figure 3 shows the incidence of scarlet fever and rheumatic fever among Army and Air Force troops in Japan and South Korea from 1946 to 1949 inclusive. The rates for the year preceding and the 2 years following the 1947 epidemic are definitely lower than was the incidence of rheumatic fever and scarlet fever in troops within the continental limits of the United States during the same period (19).

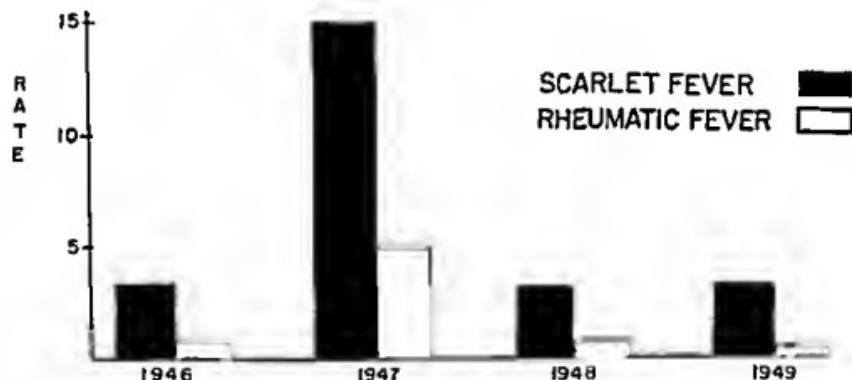


Figure 3. Rates per thousand per annum for scarlet fever and rheumatic fever in Japan and Korea during the years 1946-1949, inclusive.

Recrudescences of rheumatic fever tend to occur in about 50 percent of patients who develop subsequent hemolytic streptococcal infections. Massell (20) has shown that prompt intensive penicillin therapy for hemolytic streptococcal infections in such patients prevents recurrences. He stated that penicillin coverage must be maintained at effective levels for about 10 days if such recrudescences are to be prevented. The Armed Forces Epidemiology Board (21, 22) has recently shown that the prevention of primary rheumatic fever episodes is now fea-

(19) No significant outbreak of streptococcal respiratory infection or rheumatic fever has appeared in United Nations troops in the Korean War.

(20) Massell, B. F.: Salicylates, hormones and penicillin in treatment of rheumatic fever. *Med. Clin. N. America* 34: 149-1434, Sept. 1950.

(21) Denoy, F. W.; Wannamaker, L. W.; Brink, W. R.; Rammelkamp, C. H., Jr.; and Cuarter, E. A.: Prevention of rheumatic fever; treatment of preceding streptococcal infection. *J. A. M. A.* 143: 151-153, 13 May 1950.

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# The Royal Army Medical Corps Tradesman

Thomas P. Buist, Lieutenant Colonel, R. A. M. C.

**T**HE purpose of this article is to present a general picture of the trades of the enlisted soldiers of the Royal Army Medical Corps (R. A. M. C.) including brief accounts of the technical training involved and some indication of the relevant career prospects. A short note is included also on the new sister corps, the Queen Alexandra's Royal Army Nursing Corps (Q. A. R. A. N. C.) whose enlisted women undertake many of these trades as well.

R. A. M. C. enlisted soldiers of the active Army are either National Servicemen or regular soldiers. The former perform 2 years' compulsory service with the colors followed by 3½ years part-time service with the Territorial Army or with the Supplementary Reserve and are normally between 18 and 22 years of age when they join. The latter are men who have enlisted voluntarily for longer periods and have usually joined the R. A. M. C. with a view to a career in one of the trades of the corps. Their ages range from 17½ years upward.

The term "tradesman" is used in the R. A. M. C. in conformity with the other technical corps of the army to indicate a technician or expert trained and qualified in one of the recognized trades or specialties of these corps. In the Q. A. R. A. N. C. the corresponding term is "tradeswoman." The R. A. M. C. is a corps of tradesmen. There is no establishment for nontradesmen and in principle every soldier in the Corps who is not a tradesman is under training to obtain tradesman status.

The 18 trades of the R. A. M. C. and Q. A. R. A. N. C. include:

1. *Ten primary trades:* Nursing orderly, mental nursing orderly, special treatment orderly (venereal disease attendant), laboratory technician, physiotherapist (formerly masseur), radiographer, clerk, clerk orderly clinical (clinical secretary), technical storeman, hygiene assistant\*.

\*Enlisted women of Q. A. R. A. N. C. not eligible.

2. *Four secondary trades:* Operating theater technician, transfusion orderly\* (specializations subsequent to qualification as a nursing orderly, the second having trade status in war only), trained nurse (a progression after full training as a nursing orderly), dispenser\* (normally acquired as a second trade following qualification in one of the other trades).

3. *Four civil trades,* for which training is not provided in the Army and for which a civilian qualification is necessary: chiropodist, optician\*, pharmacist\*, surgical instrument mechanic\*.

Two additional trades (dental operating room assistant and dental hygienist) are available to the Q. A. R. A. N. C. only.

Dental and veterinary trades are otherwise the responsibility of the Royal Army Dental Corps and the Royal Army Veterinary Corps (R. A. V. C.) respectively. The R. A. V. C. is not included in the Army Medical Services.

There are normally 3 classes in each R. A. M. C. trade, class III being the junior. In general it takes at least a year to progress from class III to class II and another year to progress from class II to class I.

In selecting National Servicemen for trades involving much scientific theory, such as radiographer, the choice must be limited to young men of high talent and good education owing to the short period of service. The standard we aim at in selecting a candidate for such trades is that of a young man eligible to enter a university as a science student.

In the case of the regular soldier there is not quite the same urgency and a slightly different program is followed. In general every regular recruit is required to train and qualify as a class III nursing orderly before being trained in another trade. This phase affords the candidate the opportunity of attending classes to improve the general state of his education if necessary. The standard of raw talents required is the same in both cases.

### THE RECRUIT STAGE

The selection of a soldier for training in a specified trade depends on his assessable talents and the current requirement in the trade concerned. The selection procedure includes a talent assessment by a battery of tests followed by an interview and the preparation of a profile of the man's personality and qualities.

*Recruit training.* The first 3 months of the R. A. M. C. soldier's service are devoted to recruit training at the Depot and Training Establishment at Crookham. This includes basic military training, drill, fieldcraft, and stretcher work, together with the preliminary phase of his technical training, comprising elementary anatomy, physiology and hygiene and the basic principles of nursing and ward procedure. The preliminary

training is the same for regulars and National Servicemen and is common to all trades. The technical part of it is closely comparable to the curriculum of the initial training of a student nurse in a civil training school and is recognized by the civil authorities as equivalent to it. No R. A. M. C. soldier may commence trade training proper until he has qualified in the passing-out examination at the end of recruit training.

*The start of trade training proper.* On passing out from the Depot the young regular is normally sent to train for nursing orderly, class III, before proceeding to train in another trade. The young National Serviceman on the other hand is assigned to no appropriate unit to train for class III in his trade and takes the nursing orderly, class III, training at a later stage.

#### THE NURSING TRADES

*Nursing orderly.* The training of the regular soldier for the qualification of nursing orderly, class III, is restricted to certain military hospitals in which there is a special teaching department with a sister tutor staff. National Servicemen on the other hand may receive this training in any military hospital. The curriculum and the qualifying examinations are the same for regulars and National Servicemen and they are trained together when in the same unit. The 4-month course comprises further instruction in anatomy and physiology, hygiene, and nursing at a more advanced level than in the recruit training. On completion of the course the regulars booked for trades other than nursing proceed to training in their own trades.

Training for nursing orderly, class II, involves a year's duty as a nursing orderly, class III, of which at least 6 months must be devoted to actual nursing in hospital wards. In addition the candidate attends a course on surgery and surgical nursing. Training for class I comprises a further 12 months of practical nursing in military hospital wards and the third year lectures, on general medicine, tropical diseases and medical and infectious nursing, *materia medica*, and dietetics. A nursing orderly, class I, thus has had at least 18 months' practical nursing experience in military hospital wards. Normally it takes 3 years to obtain the class I qualification.

*Fourth year course for the qualification of trained nurse.* A nursing orderly, class I, accepted for training for the higher qualification of Army trained nurse is assigned to a selected hospital for a further year of training under the control of a sister tutor. Acceptance for this training involves special selection and the fulfillment of various educational and service conditions. The curriculum is the same as that laid down for the final stage of nurse training in civilian training hospitals and the qualifying examination is comparable to the State final examination. Before a soldier can be graded as an Army trained nurse he must have completed 3 years' actual nursing in acute wards in addition to

passing the examination and fulfilling certain other conditions. A holder of the Army trained nurse qualification is eligible to take the State examinations without additional training and so can become a State registered nurse while serving as a soldier.

### FUNCTIONS OF THE NURSING ORDERLY

Nursing orderly, class III, is the basic trade qualification of the R. A. M. C. (and of the Q. A. R. A. N. C.) and is required for advancement to class II in any of the trades of the Corps. This condition applies to both regulars and National Servicemen. The outcome is that every class II tradesman in the Corps, no matter what his personal trade may be, has been trained in basic nursing duties and in an emergency can take his place in a hospital ward. In addition, R. A. M. C. soldiers employed in various domestic and administrative functions are expected to hold at least the class III nursing orderly qualification so that they may be available for ward duty if required.

Hospital nursing is not the only technical commitment of the R. A. M. C. nursing orderly. The care of casualties in the field is an equally important part of his training and responsibilities. The two main targets for the ambitious nursing orderly are the trained nurse qualification and the trade of operating theater technician. Opportunities are available, however, for various forms of specialization such as neurosurgical, maxillofacial, thoracic, and ophthalmic nursing. Although the soldier is recorded officially as trained and experienced in such specializations, he remains a nursing orderly and has to be prepared to perform any of the other duties of his trade when the occasion arises.

*Mental nursing orderly.* This is the only trade concerned with the care and nursing of mental illness. The training follows a pattern of progressive instruction and practice while the trainee is employed in the duties of the trade. There are examinations for initial grading and advancement and it takes 3 years to attain a class I qualification. There is no fourth year course of any higher qualification, but a proportion of the regular mental nursing orderlies achieve the State civil qualification. The mental nursing orderly may specialize in occupational therapy or in the care and management of patients receiving insulin therapy.

*Special treatment orderly.* This trade has been shorn of much of its former attraction as a highly skilled occupation by the recent advances in the treatment and management of venereal diseases. These technicians are trained in the clerical and clinical laboratory duties of a venereal disease clinic as well as in the treatment of all forms of venereal disease and the nursing of inpatients. They do not, however, undertake cultural or serologic investigations. The training is received through progressive instruction and practice while the trainee is employed in venereal disease clinics. Examinations for initial grading and advancement are given. It takes 3 years to reach the class I qualification. There are no specializations within the trade.

*Operating theater duties.* The operating theater technician is a class I nursing orderly who has been trained subsequently for special technical duties. These include the servicing of cutting instruments and minor repairs to other surgical and electrical equipment in addition to active membership in the surgical team, before, during, and after operations. The training includes instruction by a cutler as well as an apprenticeship training in the operating theater.

*Transfusion.* There is no separate trade of transfusion orderly except in war. Under peace conditions selected nursing orderlies are trained in transfusion duties as a specialization but their trade remains nursing orderly. The course includes relevant elementary laboratory work as well as training in the clinical procedures of transfusion. It may be noted in passing that the laboratory work of a transfusion center is normally performed by laboratory technicians with special training in this branch. Under war conditions nursing orderlies trained in transfusion duties are graded as "transfusion orderlies" and relinquish their nursing orderly status.

#### OTHER TRADES CONCERNED IN MEDICAL CARE AND TREATMENT

*Radiographer.* The primary function of the R. A. M. C. radiographer is diagnostic radiography. The instruction includes the basic principles of radiotherapy, but practical training in this branch of x-ray technic is regarded as a specialist training and is normally only undertaken by radiographers already qualified otherwise. Other specialties in this trade are mass miniature radiography and clinical photography. The basic technical training of all radiographers is a 4-month course in the Army X-Ray School at the end of which successful candidates are graded as class III radiographers and are assigned to x-ray departments for a continuation of their training. Progress to class I takes another 2 years and includes examinations for advancement to class II and class I. The class I qualification is recognized by the Society of Radiographers and exempts the holder from part of the final examination for membership in the Society.

*Physiotherapist.* The training for physiotherapist, class III, is a 10-month course at the Army School of Physiotherapy and is the longest of the R. A. M. C. technical courses. The curriculum includes the various radiation and electrotherapeutic technics as well as massage and remedial exercise. Two years' work as a physiotherapist are required for progression to class I.

*Chiropodist and optician.* These auxiliaries are not trained in the service. The requirement is met by the enlistment of men already trained and qualified under civil arrangements.

#### LABORATORY AND PUBLIC HEALTH

*Laboratory technician.* Most of the National Servicemen selected for this trade were student medical laboratory technicians in civil life and have already had material training and experience. The training of a

and I on acquiring the appropriate higher qualifications. This system offers opportunity for accelerated promotion to the talented soldier who is prepared to make the best use of his gifts and his time. The R. A. M. C. soldier who possesses the necessary qualities can attain commissioned rank as an administrative and technical officer, a quartermaster, or a medical equipment branch officer.

*Career as a technician.* Although military promotion in the R. A. M. C. is primarily regimental, the establishment of the Corps provides appointments in all trades up to the rank of sergeant, and, in some trades, appointments for staff sergeants and warrant officers as well. This does, in effect, afford such tradesmen a form of career ladder within the trade itself, but this is incidental rather than planned. For example, a clerk R. A. M. C. may serve in a clerical capacity up to the rank of warrant officer, class I. In some trades there is the opportunity for promotion in due course to commissioned rank in the same technical field. In such cases, although the promotion through the various ranks up to warrant officer is dependent at each stage on educational and regimental factors as well as on technical progress, it is in fact his special quality as a technician which determines the axis of the soldier's career and leads in the end to his commission.

*Education in the R. A. M. C.* The educational factor in promotion in the R. A. M. C. deserves a brief explanation. Although a material proportion of the men who take regular engagements in the Corps are up to university entrance standard at enlistment, many have had only an elementary education and are ill-equipped to undertake technical training involving scientific theory. The Army provides good facilities for general education, however, and the soldier who has the basic talent and the determination can retrieve his broken education and progress up to university entrance standard and beyond.

#### THE Q. A. R. A. N. C.

The Q. A. R. A. N. C. acquired its own enlisted ranks establishment in July 1950. Previously this Corps had consisted of commissioned nurses only, the subordinate staff in the military wards being R. A. M. C. soldiers. During World War II and subsequently these R. A. M. C. soldiers were supplemented and partly replaced by members of the Voluntary Aid Detachments (female) and by women orderlies of the wartime Auxiliary Territorial Service or of the more recent Women's Royal Army Corps or "W. R. A. C." Now the subordinate nursing staff in the military wards is composed of R. A. M. C. and Q. A. R. A. N. C. nursing orderlies. The role of the latter Corps, however, is not limited to nursing and many of the R. A. M. C. trades are open also to women of the Q. A. R. A. N. C.

It may be added that the women of the Q. A. R. A. N. C. are enlisted in the same way as the regular R. A. M. C. soldier, that their trade training is identical except for minor details and that in many cases the

tradesman and tradeswoman are trained together. The tradeswoman has the same opportunity as the tradesman of attaining the recognized civil qualifications and both have the same facilities for continuing their general education. Finally the promotion system in the Q. A. R. A. N. C. is constructed on the same principles as that of the regular R. A. M. C., with 3 grades of queue for every step in promotion and with military, educational, and technical factors operating at each of them.

### CONCLUSION

In the foregoing description of the R. A. M. C. tradesman and the Q. A. R. A. N. C. tradeswoman, details have been avoided as far as possible because these are constantly changing. The account which has been given is intended to present a general picture which can be accepted as a relatively static one.

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### BOOK REVIEW

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*Psychological Factors of Peace and War*, edited by T. H. Pear. Contributions by G. W. Allport, J. Cohen, H. V. Dicks, H. J. Eysenck, J. C. Flugel, Hilde Himmelweit, Madeline Kerr, T. H. Pear, L. F. Richardson. 262 pages. The Philosophical Library, Inc., New York, N. Y., publishers, 1950. Price \$4.75.

Professor Pear has performed an excellent service in collecting and editing a series of professional papers concerning the cause of war. Under the sponsorship of the United Nations Association, eminent psychiatrists, sociologists, and psychologists of England and the United States pooled their contributions into a meaningful unit. This book requires no broad technical knowledge of psychology, although familiarity with methods of psychologic research is helpful in understanding the last 4 chapters.

Provocative inquiries are presented and scientific hypotheses are proposed as areas for consideration and further investigation. A good case is made for education of the public; research evidence is overwhelming in demonstrating the severe lack of agreement between social scientists and the lay population (voters) concerning the causes of war. The relative readiness of man to accept war as being inevitable is put to searching inquiry by Dr. Himmelweit and comes out a poor second. The role of the concept of aggression apparently needs further study to close the gap between laboratory findings and real situations confronting a social group. The popular trend in assigning "typical characteristics of a nationality" is denounced with professional clarity by Dr. Dicks with a summary of psychiatric research on the topic.

Dr. Richardson epitomizes the tone of the volume in stating that general statements can be examined, verified, or denied by collecting the facts from the entire world over a century or more. Typical developments of group responsiveness to threat (from another group), with reactions of contempt, submission, negotiation, avoidance, or retaliation are cited from recent happenings well within memory span of the reader. Professor Kerr proposes that extensive studies be made of societies in which prestige is given a high value as well as of the relation between economic factors and psychologic elements.

Dr. Flugel succinctly illustrates why the reliance of the League of Nations, and now the United Nations, on an intellectual appreciation of their necessity largely explains their lack of success. Professor Allport makes a strong appeal for social research focused on concurrent and interlocking problems of nations for the purpose of enhancing international cooperation. Such efforts may well be centered on education, child welfare and health because "adults are the bigots." Propaganda also needs further scientific appraisal to further international unity and to prevent war. A wealth of material has here been compressed into a relatively few pages. This book is recommended without reservation for wide reading.

—Lt. Col. F. A. Zebrer, MSC, U. S. A.

**Dible and Davie's Pathology, An Introduction to Medicine and Surgery,** by J. Henry Dible, M. B. (Glas.), F. R. C. P. (Lond.), Professor of Pathology in the University of London (Post-Graduate Medical School of London); Late Professor of Pathology at the London School of Medicine for Women, Professor of Pathology in the Welsh National School of Medicine, and Professor of Pathology in the University of Liverpool. 3d edition 963 pages, 417 illustrations including 9 plates in color. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1950

This book is based on lectures delivered by the authors to medical students. The writers point out that they have endeavored to discuss the most important processes at the greatest length. This arbitrary selection of subject material has resulted in the exclusion of such diseases as scleroderma, lupus erythematosus and dermatomyositis. The arrangement of the book follows a system which the authors found convenient in teaching. Inflammation and the basic processes of pathology are dealt with in the first section, special infections, in the second; and systemic pathology, including the important pathologic processes not previously discussed, in the third. The authors have stressed the natural history of disease in the hope of stimulating the student to think. The addition of a bibliography would be of use to those students wishing to review original reference material. Some of the illustrations are excellent and a few are of doubtful value. Figure 80 leaves the impression that papillomatous warts are due to scratching. The book should be valuable chiefly to medical students.—F. B. Helwig, M. D.

# Terramycin in Tuberculous Otitis Media

Leon L. Titche, Major, MC, U. S. A. R. (1)

THE discovery of terramycin by Finlay and his co-workers (2) was followed by the investigation of its antibiotic properties by them and numerous other workers (3-9) who showed that the substance was effective against diseases caused by many of the aerobic and anaerobic gram-positive and gram-negative bacteria, the rickettsias and certain viruses. The first work on the use of terramycin in tuberculosis was by Hobby (10) who found that it suppressed experimental tuberculous infections in guinea pigs and mice. This was confirmed by Steenken and Wolinsky (11) who also showed that it was effective against streptomycin-resistant strains of the tubercle bacillus in experimental ani-

(1) Veterans Administration Hospital, Tucson, Ariz.

(2) Finlay, A. C.; Hobby, G. L.; P'an, S. Y.; Regna, P. P.; Routen, J. B.; Seeley, D. B.; Shull, G. M.; Sobin, B. A.; Solomons, J. A.; Vinson, J. W.; and Kane, J. H.: Terramycin: new antibiotic. *Science* 111: 85, Jan. 27, 1950.

(3) Herrell, W. E.; Heilman, F. R.; Wellman, W. E.; and Bartholomew, L. G.: Terramycin: some pharmacologic and clinical observations. *Proc. Staff Meet. Mayo Clin.* 25: 183-196, Apr. 12, 1950.

(4) Hoffman, M. S.; Wellman, W. E.; and Herrell, W. E.: Failure of absorption of aureomycin and terramycin administered as retention enema. *Proc. Staff Meet. Mayo Clin.* 25: 463-464, Aug. 2, 1950.

(5) King, E. Q.; Lewis, C. N.; Welch, H.; Clark, E. A., Jr.; Johnson, J. B.; Lyons, J. B.; Scott, R. B.; and Cornely, P. B.: Clinical observations on use of terramycin hydrochloride. *J. A. M. A.* 143: 1-4, May 6, 1950.

(6) Melcher, G. W., Jr.; Gibson, C. D., Jr.; Rose, H. M.; and Kneeland, Y., Jr.: Terramycin in treatment of pneumonococcal and primary atypical pneumonia. *J. A. M. A.* 143: 1303-1309, Aug. 12, 1950.

(7) Parry, E.: Newer therapeutic agents. *South Dakota J. Med. & Pharm.* 3: 189-190, June 1950.

(8) Pratt, P. T.: Preliminary report on use of terramycin in pneumonia. *Nebraska M. J.* 35: 294-295, Sept. 1950.

(9) Werner, C. A.; Knight, V.; and McDermott, W.: Absorption and excretion of terramycin in humans; comparison with aureomycin and chloramphenicol. *Proc. Exper. Biol. & Med.* 74: 261-267, June 1950.

(10) Hobby, G. L.: Tuberculostatic activity of terramycin and viomycin. *Proc. Ninth Streptomycin Conference.* pp. 192-198, 1950.

(11) Steenken, W., Jr., and Wolinsky, E.: In vitro and in vivo antituberculous activity of terramycin and viomycin. *Proc. Ninth Streptomycin Conference.* pp. 189-192, 1950.

mals. Youmans (12) studied the effectiveness of the antibiotics in experimental tuberculosis in mice and found others to be superior to terramycin. Knight (13) reported that terramycin was not effective against tuberculosis in man. Bunn (13) reported beneficial effects in a few patients and at the tenth Streptomycin Conference in January 1951 radiologic improvement was reported in 12 of 15 patients and sputum conversion in 5 under terramycin therapy by one of the reporting hospitals.

The following case is being reported solely to bring out the fact that improvement followed terramycin therapy in a patient with tuberculous otitis media in whom the organisms were resistant to streptomycin. In the patients reported in the literature, terramycin was given by mouth. In the case presented here, it was applied locally, using the same method by which streptomycin had been given in a previous series of patients (14).

### CASE REPORT

A man, 27 years of age, entered the hospital on 12 June 1949 with a diagnosis of tuberculosis, pulmonary, chronic, reinfection type, far advanced, of about 3 months' duration. A roentgenogram of his chest revealed lesions in both upper lobes of the cavitary type. His sputum was positive for tubercle bacilli on smear and culture. One gram of streptomycin was given twice a day for 2 weeks followed by 1 gram daily for 4 months because the organisms were sensitive to a concentration of less than 1 microgram per cc. Practically no improvement was noted clinically or on roentgenologic examination and the organisms were found to be resistant to a concentration of streptomycin between 10 and 100 micrograms per cc. at the end of antibiotic therapy. A temporary crushing of the left phrenic nerve was performed on 27 October. "neumoperitoneum" was started and has been continued. Roentgenograms have shown essentially no change during his course in the hospital.

On 2 October 1950 the patient complained of a discharge from his left ear. Examination revealed the external canal to be filled with mucopurulent material. The tympanic membrane showed a large perforation posteriorly and inferiorly. The middle ear was filled with mucopurulent secretion. Direct smear did not yield acid-fast bacilli, but a culture of the material revealed such organisms, which proved resistant to streptomycin in a concentration between 10 and 100 micrograms per cc. Before a report was received on the culture penicillin was given parenterally and locally without any improvement so 0.1 gram of streptomycin

(12) Youmans, G. P.: Comparative effectiveness of chemotherapeutic agents upon experimental tuberculosis of mice. Proc. Ninth Streptomycin Conference, pp. 193-199, 1950.

(13) Knight, V.: Clinical evaluation of streptomycin, chloramphenicol, and terramycin (Discussion by Bunn, P. A.) New York State J. Med. 50: 2173-2181, Sept. 15, 1950.

(14) Titché, L. L.: Streptomycin in treatment of tuberculous otitis media; evaluation. Arch. Otolaryng. 51: 826-830, June 1950.

was instilled locally into the ear daily in the hope that the organisms in the ear were not streptomycin-resistant like those in the sputum. Roentgenologic examination revealed an infected mastoid process on the left side and re-examination 4 weeks later showed that the involvement had progressed. On 29 November 50 mg. of terramycin in 1 cc. of distilled water was instilled locally into the left ear daily. On 3 January 1951 the ear was found to be dry and has remained so. An applicator was inserted into the middle ear on 10 January in an attempt to obtain material for smear and culture for acid-fast bacilli and these examinations were negative for organisms. A roentgenogram taken on 9 January revealed clearing of the mastoid cells on the left. The patient at this time had no complaints referable to his ears.

#### SUMMARY

Tuberculous otitis media and mastoiditis was caused by organisms that were resistant to streptomycin in a patient in whom the infection progressed under streptomycin therapy. When terramycin was employed locally the otitis and mastoiditis cleared up.

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#### BOOK REVIEW

*Obstetrical Practice*, by Alfred C. Beck, M. O., Professor Emeritus of Obstetrics and Gynecology, State University of New York, College of Medicine at New York City; formerly Professor of Obstetrics and Gynecology, Long Island College of Medicine; formerly Obstetrician and Gynecologist-in-Chief, Long Island College Hospital; Consultant in Obstetrics and Gynecology, Long Island College Hospital and Norwegian Hospital, Brooklyn, N. Y., U. S. Naval Hospital, St. Albans, N. Y., Vassar Brothers Hospital and St. Francis Hospital, Poughkeepsie, N. Y. 5th edition. 1073 pages; with 969 illustrations. The Williams & Wilkins Co., Baltimore, Md., publisher, 1951. Price \$10.

This book takes into account the many advances made in obstetrics since the publication of the fourth edition. Most of the new edition has been rewritten and many new illustrations have been added. A new feature is an appendix consisting of 22 roentgenograms. Gillam's recent observations have been incorporated in the chapter on the development of the ovaries along with those of Corner and Prever. The work of Markee, Daron, Schagel, Daalgard, Fluhmann, and Haman on menstruation, and that of Heuser, Streeter, Hertig, and Rock on the developing fertilized ovum, have been given recognition. The chapter on the physiology of the fetus has been revised to include the work of Barcroft and Barron and of Snyder and Rosenfeld on the respiratory movements of the fetus. Barcroft's reports on blood and circulation have been incorporated in this chapter in addition to Gruenwald and Popper's studies

of the kidney. The chapter on the changes taking place in the mother during pregnancy has been extensively revised. Of particular note are the changes suggested by the studies on the isthmus and cervix by Ivy, Danforth, and Stieve. There is an adequate description of the newer tests for pregnancy.

The chapter on management of pregnancy stresses the role of diet during pregnancy. The growing importance of pelvimetry is emphasized. The revised chapter on presentation and posture is accompanied by a new set of illustrations. In describing the stages of labor and their management the author makes a strong plea for conservative treatment in the third stage.

The chapter on medical and surgical complications of pregnancy replaces the older one on the toxemias of pregnancy and includes a discussion of the Rh factor, hypertensive vascular disease, phlebothrombosis, rubella, and the modern treatment of syphilis with antibiotics. The newer concepts of uterine inertia and use of posterior pituitary extract for this condition is ably discussed. The recommended management of placenta praevia has been changed to conform with the observations of Williams, Macafee, and Johnson. This book should be of great value to undergraduates and young practitioners.

—Lt. Col. H. L. Riva, MC, U. S. A.

**Administrative Housekeeping.** by Alta M. La Belle, Consultant on Housekeeping and Interior Design, former Director of Housekeeping, Michael Reese Hospital, Chicago, and Jane Barton, Associate Editor, *The Modern Hospital*. 420 pages, illustrated. G. P. Putnam's Sons, New York, N. Y., publishers, 1951. Price \$5.50.

The authors of this book have presented in an easily readable style an exposition of the modern philosophies of industrial psychology and personnel management as applied to the field of institutional housekeeping. This book, however, is much more than a philosophical treatise in that it provides a practical approach to the solution of the everyday problems met by those responsible for the maintenance of hospital facilities. To quote the authors, "Theoretical knowledge is worthless unless methods of application are also understood and carefully followed." An excellent index provides a ready means of finding the answer to almost every conceivable problem confronting the institutional housekeeper whether he is the maintenance officer of a military hospital or a member of the administrative staff of a civilian hospital. This book should fit nicely into the curriculum of schools of hospital administration and is a valuable contribution to the libraries of hospital administrators and housekeepers.—Capt. C. R. Wilcox, MC, U. S. N.

# Intestinal Obstruction<sup>(1)</sup>

Marshall N. Jensen, Colonel, U. S. A. F. (MC)

Irving K. Ettman, Lieutenant Colonel, U. S. A. F. (MC)

THE mortality rate of intestinal obstruction has been greatly reduced as a result of its earlier recognition and the use of more rational therapy. Difficulty in diagnosis is frequently encountered, especially in patients of the younger age group or when the acute phase is made obscure by insidious onset and vague symptoms. Recognition and proper treatment of intestinal obstruction require special consideration of the various clinical types. The causes of intestinal obstruction may be mechanical or paralytic. Vangensteen (2) calls the latter inhibitive. Three cases of intestinal obstruction are reported here because of unusual features observed in each.

## CASE REPORTS

**Case 1.** A 21-year-old man was admitted to this hospital on 6 June 1951 because of severe abdominal pain, obstipation of 4 days' duration, and progressive distention of the abdomen. Paroxysmal cramping abdominal pains were occurring at intervals of from 1 to 2 minutes. Since childhood the patient had experienced episodes of abdominal pain coming on about 2 hours after meals and subsiding gradually. He gave no history of constipation. He had noticed that his abdomen would become greatly distended when flying at altitudes of over 20,000 feet. In 1949 a routine roentgenogram of the chest (fig. 1) showed a marked distention of the colon, and one of the abdomen at that time revealed evidence of a megacolon.

Physical examination on admission revealed marked distention of the abdomen with increased peristalsis and visible peristaltic waves in the left upper abdominal quadrant. The latter were synchronous with the crampy abdominal pains. The pulse was rapid and the white blood cell count elevated. A roentgenogram of the abdomen revealed a tremendously enlarged loop of large bowel which extended across the entire abdomen from right to left and another loop of colon distended with gas and lying just beneath the first loop and separated from it

(1) Air Force Hospital, March Air Force Base, Calif.

(2) Vangensteen, O. H.: *Intestinal Obstructions*. 2d edition. Charles C Thomas, Publisher, Springfield, Ill., 1945. p. 151.

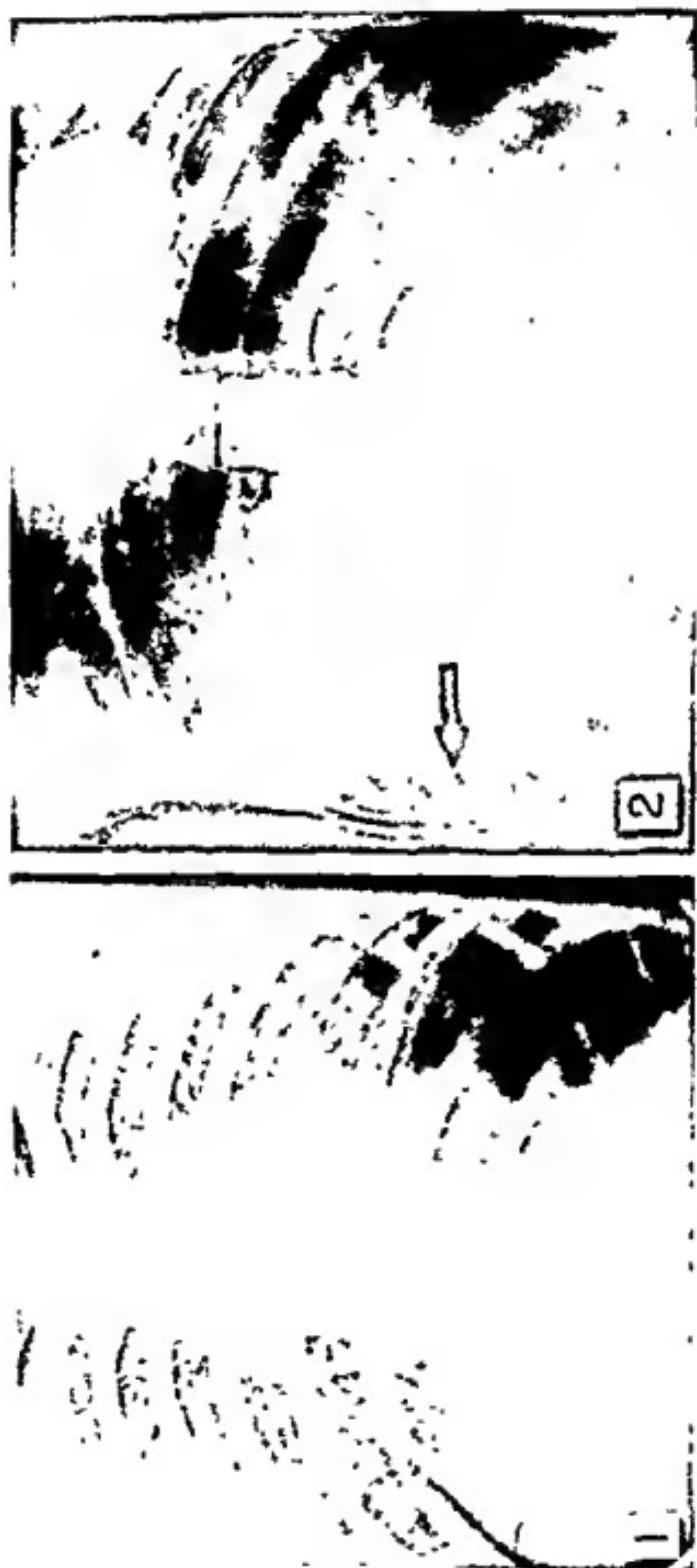


Figure 1 (case 1). Roentgenogram of the chest showing gaseous distension of the colon. Figure 2 (case 1). Roentgenogram taken after operation.

in the left upper abdominal quadrant by a narrow loop of colon. A diagnosis of megacolon with volvulus was made.

An exploratory laparotomy was performed and a volvulus was found at the juncture of the descending and sigmoid colon. The transverse colon was distended to a diameter of about 18 inches. The volvulus was released, the distal 7 inches of descending colon and proximal 7 inches of the sigmoid were removed, and an end-to-end anastomosis was performed. Ten days later a transverse colostomy was performed because of suspected leakage from the anastomosis. Later a closure of the colostomy with end-to-end anastomosis was performed and the patient became and remained free of symptoms. A roentgenogram taken several days after operation (fig. 2) showed the enlarged colon and the presence of air in the peritoneal cavity.

Case 2. A 26-year-old woman was admitted to this hospital on 14 May 1951 because of cramping upper abdominal pain and tarry stools of 3 days' duration. Her red blood cell count was 2,000,000 and the hemoglobin 6.5 gm. Since 1940 she had had 5 episodes of thrombophlebitis involving the veins of the lower extremities. The initial episode was at the age of 16 and followed an appendectomy and removal of an ovarian cyst. Three pregnancies have subsequently occurred, each associated with thrombophlebitis. A cholecystectomy in 1944 was followed by a 2-month period in bed, at which time a vena cava ligation was considered but not performed. In May 1950 marked abdominal swelling, associated with cramping pain and tarry stools, had occurred. This episode subsided in 1 month without hospitalization, and no diagnosis was made.

In the 6 days following admission, blood transfusions totaling 4,500 cc. were given and her condition improved. On the third hospital day, marked abdominal distention developed. A paracentesis revealed that this was due to ascites. She was placed on a low salt diet and given a mercurial diuretic following which she improved. A gastrointestinal series suggested esophageal varices. Liver function tests were within normal limits. A tentative diagnosis of portal hypertension secondary to portal vein thrombosis was made, and a splenorenal shunt was planned. Because of the continuous cramping abdominal pain in the early days of this illness, it was thought that some degree of mesenteric thrombosis was present.

The patient was discharged from the hospital on 28 May, but returned on 1 June with abdominal distention, cramping pain, vomiting, and bloody stools. A fluid wave was present in her abdomen; her pulse was 120; and her temperature was 100° F. On 4 June a roentgenogram of the abdomen in the erect position revealed numerous loops of small intestine containing gas-capped fluid. Valvulae conniventes within the bowel were also noted (fig. 3). An x-ray diagnosis of small intestinal obstruction was made.

On 4 June a right paramedian incision was made. On opening the peritoneal cavity, blood-tinged fluid escaped. The small bowel was gangrenous from 12 inches distal to the ligament of Treitz to 3 feet proximal to the ileocolic junction. The mesenteric veins were thrombosed but the arterial supply was intact. Resection and end-to-end anastomosis was performed at the ligament of Treitz, leaving about 2 feet of ileum. The spleen and liver were not enlarged and appeared to be normal. The patient's postoperative course was smooth. A postoperative diagnosis of small intestinal obstruction due to thrombosis of the mesenteric veins was made.



Figure 3 (case 2). Roentgenogram taken before operation showing the gas-distended loops of small intestines. Cross striations of mucosal folds or valvulae conniventes are noted in the jejunum.

**Case 3.** A 4-year-old boy was admitted to this hospital on 25 March 1951, 24 hours after a concrete bird bath had fallen across his abdomen. He complained of abdominal pain. His temperature was elevated and there was clinical evidence of an adynamic ileus. Physical examination revealed marked tenderness and abdominal rigidity. The abdomen was slightly distended with no definite evidence of shifting dullness. A roentgenogram on 26 March (fig. 4) revealed multiple loops of small

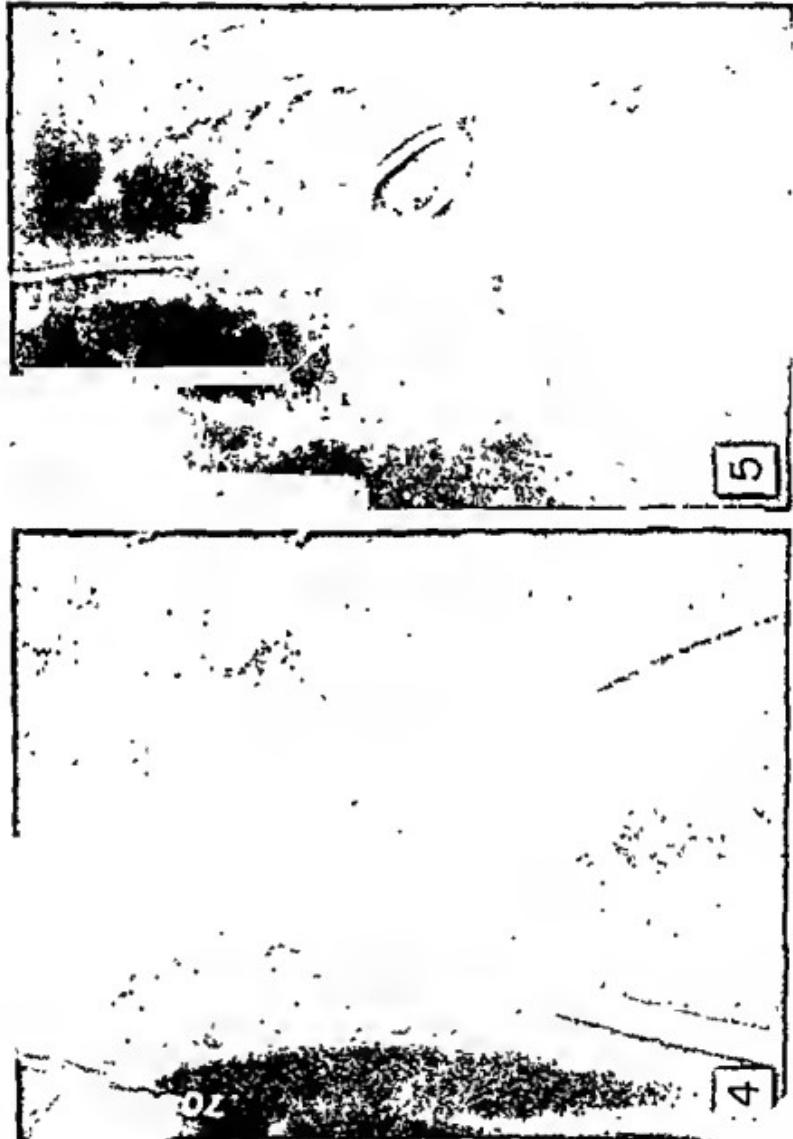


Figure 4 (case 3). Roentgenogram of the abdomen showing gaseous distention of intestines. Figure 5 (case 3). Roentgenogram taken on readmission revealing the gas-capped fluid levels in the small intestine and the tip of the Miller-Abbott tube at the site of the obstruction.

and large bowel distended with gas, but no evidence of free air under the diaphragm. A tentative diagnosis of ileus, secondary to trauma was made.

Conservative treatment with a Miller-Abbott tube and Wangensteen suction apparatus, intravenous fluids, and antibiotics resulted in gradual recovery. On the eleventh day after injury, the patient passed several loose stools, including whole corn kernels eaten the day before injury. The patient was discharged on the following day, symptom free. One month after injury he was readmitted because of abdominal distention, persistent vomiting, and visual evidence of hyperperistalsis. A roentgenogram of the abdomen (fig. 5) revealed small gas-capped fluid levels in the small intestine. A diagnosis of small bowel obstruction was made.

On 26 April a laparotomy was performed and a healed rupture at the jejunio-ileal junction was found. This was the site of an old abscess. Nearly complete obstruction of the small intestine was present at this point, but the bowel was definitely viable. Resection of 4 inches of small intestine was performed and end-to-end anastomosis was made. The postoperative course was uneventful. The postoperative diagnosis was intestinal obstruction, secondary to previously ruptured small intestine and resulting cicatrix.

#### DISCUSSION

Volvulus associated with megacolon is unusual, but is common enough that it should be considered. Golden (3) stated that he had seen only 2 cases and found it impossible to determine whether the megacolon was secondary to the repeated twists in the sigmoid, or the volvulus developed in the already dilated colon. The treatment is usually surgical, but Brown and Ross (4) reported 4 cases relieved by nonsurgical methods.

Thrombosis of the mesenteric veins leads to paralytic obstruction in the small intestines, resulting in a distention of the involved segment with an accumulation of bloody fluid and loss of viability of the bowel wall. Trotter (5) collected 360 cases with mesenteric thrombosis and embolism. Arterial occlusion contributed to 60 percent of these and thrombosis of the mesenteric vessels the rest. Venous thrombosis is usually associated with infection of the abdominal organs and tributaries of the portal vein, such as appendicitis, pelvic infection, etcetera. In case 2 there was no apparent cause for thrombosis in the mesenteric veins and, in view of the previous history of frequent

(3) Golden, R. (editor). Diagnostic Roentgenology. Thomas Nelson & Sons, New York, N. Y., 1948, vol. 1, p. 343.

(4) Brown, R. B., and Ross, D. Congenital abnormalities of intestinal rotation and mesenteric attachment; cause of intestinal obstruction in adult. Ann Surg. 134: 849, July 1951.

(5) Trotter Cited by Wangensteen, O. H.: Vascular obstruction; intestinal obstruction due to mesenteric thrombosis and embolism. In Christopher, F. (editor). Textbook of Surgery. F. D. Saunders Co., Philadelphia, Pa., 1942, p. 1215.

phlebitis in the veins of the lower extremities, the thrombosis may have been spontaneous.

Blunt trauma to the abdomen resulting in strictures and adhesions of the intestines, followed at a later date by intestinal obstruction, is said to be uncommon. The usual cause of such cases is severance of the mesentery attached to a short segment of the intestine with subsequent cicatrization of the intestinal wall. The delay of symptoms of obstruction in the small bowel is due to the fluid nature of the intestinal contents. Narrowing of the lumen must be almost complete before symptoms develop.

#### SUMMARY

Three cases of intestinal obstruction have been presented because of their unusual nature. The type of obstruction was particularly unusual in the age group in which it occurred. These cases were observed in a short space of time on a relatively small surgical service and indicate the necessity for being on the alert for intestinal obstruction.

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#### BOOK REVIEWS

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*An Introduction to Modern Psychology*, by O. L. Zangwill. 227 pages; 20 illustrations. Philosophical Library, New York, N. Y., publisher, 1950. Price \$3.75.

In this compact book, Oxford University's Professor Zangwill presents a remarkably clear and concise picture of contemporary psychology. Emphasis is placed on those trends which denote the way in which "psychology is gradually taking shape as a branch of biological science," but the scope is broad enough to include a dispassionate treatment of Freudian theory, free from the blind and often impudent negations of a decade ago. The book is distinguished by its excellent literary style, which consistently reminds one of the linguistic sensitivity and skill displayed by William James. The author achieves condensation of material by combining this verbal precision with a careful selection of representative topics. As a result, no major segment of contemporary psychology is ignored.

The book proceeds from a treatment of background material, through sensory processes, learning and intellect, neural integration, appetitive and emotional phenomena, intelligence and mental measurement, psychoanalysis, and personality, to an optimistic forecast of psychologic trends in relation to neurology, the practical demands of social planning, and social science in general. The fundamental viewpoint is that of the experimentalist convinced "that the object of psychology is to understand human behaviour irrespective of what may happen to be the prevailing human situation."

Many American psychologists will not be satisfied with the rather blunt characterization of factorial methods as "a brilliant but misguided departure from the central path of empirical psychology." It is regrettable that the author did not think it necessary to temper this view by reference to the work of Thurstone, Guilford, and others. There can be no doubt, however, of the sincerity of conviction shown in this appraisal. Likewise, the author's unusually forthright stand in favor of certain hereditary influences will be met with some skepticism, but the stand itself is refreshing in an era marked by reluctance and equivocation.

The book is not "introductory" within the customary meaning of the term, for it presupposes some fundamental acquaintance with general psychology and related disciplines. Graduate students in psychology, whose minds are sometimes cluttered with conflicting details and discouraging uncertainties, will find it stimulating and reassuring. It will be informative to the educated man in science, medicine, and the humanities, yet it was written for none of these in particular, but gives the impression that it is a scholarly piece of work, done for the sake of scholarship.—*Maj. R. B. Payne, U. S. A. F. (MSC)*

**711 Medical Maxims**, by William S. Reveno, M. D., Assistant Professor of Clinical Medicine, Wayne University Medical College, Attending Physician, Harper Hospital, Consulting Physician, Detroit Receiving and Highland Park General Hospitals, Detroit, Mich., with forewords by Frederick A. Collier, M. D., and William J. Kerr, M. D. 197 pages. Charles C Thomas, Publisher, Springfield, Ill., 1951. Price \$3.75.

This book of medical maxims was written by a physician of wide clinical experience. The maxims are concise and have direct clinical application. These aphorisms are genuine "pearls" which should be of great value to medical men in general and to interns or medical students in particular. The maxims have been arranged in accordance with the various organ systems of the body. The index occupies 74 pages of the book and is so worded as to be of aid in differential diagnosis. The binding is good and the paper nonglossy. This book is timely and contains much medical wisdom which would be most difficult to find in the usual textbooks. It can be recommended for those who wish to profit by the experience of an excellent clinician.

—*Lt. Col. B. A. Niebol, MC, U. S. A.*

# Combined Pulmonary Tuberculosis and Carcinoma of the Lung

Alvin S. Hambly, Jr., Lieutenant, junior grade, MC, U. S. N. R. (1)

THE combination of pulmonary tuberculosis and carcinoma of the lung has been recognized for more than a century. Only in the last 25 years, however, has it been considered of distinct clinical significance. Increasingly frequent case reports, and especially the large series being reported by Farber et al. (2), has led to renewed interest in the etiologic and differential diagnostic aspects of this combination of diseases.

## HISTORY

Rokitansky (3) discussed this combination from the point of view of the histologic findings and a possible etiologic relationship. His conclusions have since been the source of much discussion and are not without supporters today. Because of the difference in the general pathologic patterns of the two diseases and because of the rarity of patients showing the combination, he believed that the processes were fundamentally antagonistic. He was not the first to predicate antagonism, but he was one of the strongest supporters of this view. Among the earliest reported cases of combined pulmonary tuberculosis and lung cancer were those of Bayle (better known as Laennec's teacher) in 1810, and Friedlander in 1885 (4). The French literature of the early nineteenth century also contains pertinent case reports. Wolf reported two cases in 1895 (4). Subsequent case reports have become increasingly more frequent and inclusive of larger numbers of cases (5).

(1) Fitzsimons Army Hospital, Denver, Colo.

(2) Farber, S. M., et al.: Personal communication.

(3) Rokitansky, C.: A Manual of Pathological Anatomy. Vol. 1. Sydenham Society, London, 1852, pp. 311-315.

(4) Hueper, W. C.: Tuberculosis and cancer. Am. Rev. Tuberc. 22: 271-285, Sept. 1930.

(5) Cooper, F. G.: The association of tuberculosis and carcinoma. Am. Rev. Tuberc. 25: 108-147, 1932.

## ETIOLOGY

In the 1928 edition of his textbook of tumor pathology Ewing (6) flatly stated that tuberculosis was the chief etiologic agent of carcinoma of the lung. This sweeping statement was apparently based on the findings in one series of 31 cases. This apparently provoked considerable thought as the greatest concentration of articles readily available in the literature appeared in the few years following the appearance of the text. The pertinent data may be grouped under 4 hypotheses:

### *1. Carcinoma and tuberculosis are antagonistic*

This doctrine has been postulated for more than 100 years, and even prior to Rokitansky the idea was widely suggested. In late years it has been supported by the following evidence: (a) an inverse relationship appears to exist in many countries, i. e., counties having a high death rate from tuberculosis usually have a low death rate from carcinoma; (b) colored races have a low incidence of cancer, but a high incidence of tuberculosis; and (c) a general decline recently in tuberculosis mortality has been associated with a rise in cancer mortality. Many older series of carcinoma patients have been reported to show no active tuberculosis.

Additional credence to this view was given by Pearl (7), who reported a study of 1,632 patients, equally divided into a carcinoma group and a control group, the latter being carefully matched with respect to age, sex, race, and approximate year of death. The only selective factor imposed on the control group was that they had no demonstrable malignancy. The study included all varieties of malignancy. The results apparently showed that a definite antagonism existed between active tuberculosis and carcinoma and that even greater antagonism was noted between tuberculosis and sarcoma. No significant difference was found in "nontuberculous" patients and those with healed gross disease. Pearl felt so strongly about this that he advocated the tuberculin treatment of carcinoma.

Fried (8), however, denied that antagonism existed. He noted that the combination of these diseases is being observed more frequently clinically and that they can be reproduced experimentally in the same animal. Carlson and Bell (9) studied statistically 11,195 postmortem examinations with respect to frequency of occurrence of these diseases in the same patient. It is possible that their work was not inspired

(6) Ewing, J. *Neoplastic Diseases*. 3d edition. W. B. Saunders Co., Philadelphia, Pa., 1928 p 873. Also the 4th edition.

(7) Pearl, R. *Cancer and tuberculosis*. Am. J. Hyg. 9: 97-159, Jan. 1929.

(8) Fried, B. M. *Biochemical cancer combined with tuberculosis of lungs*. Am. J. Cancer 23: 247-266, Feb. 1935.

(9) Carlson, H. A., and Bell, E. T. *Statistical study of occurrence of cancer and tuberculosis in 11,195 postmortem examinations*. J. Cancer Research 13: 126-135, July 1929.

by Peat's study, but pointed criticisms were directed at his methods. They held that the only adequate control group for a study involving carcinoma patients is not a random selection, but a group of patients with another disease. Apparently because of its prevalence, heart disease of all kinds was chosen for their control group. They found active tuberculosis to be much less frequent in cancerous than in non-cancerous subjects, and cancer to be much less common in those with active tuberculosis than in those with no tuberculosis or with healed tuberculosis. They found active tuberculosis to be even less frequently associated with heart disease than with cancer; and cancer to be less frequently associated with heart disease than with active tuberculosis.

These results do not mean that active tuberculosis inhibits the development of both cancer and heart disease. They arise from the fact that most persons with active tuberculosis have no other major illness and therefore a higher percentage of the control patients (those with no cancer or no heart disease) must always be found to have tuberculosis. These writers found no statistical evidence to support the view that there is an antagonism between cancer and tuberculosis.

### *2. Tuberculosis as a precancerous lesion.*

Some experimental evidence for this view was given by Cherry (10) in his report on the increased incidence of all tumors including carcinoma in mice inoculated with small amounts of tubercle bacilli. This has not been successfully repeated to my knowledge. Occasional cases have been reported in support of this view (11, 12) but the rarity of these case reports, and the absence of large numbers of tuberculosis patients developing cancer leaves the hypothesis open to doubt (4, 13). Fried (8) stated that, contrary to Ewing's view, carcinoma did not develop in tuberculous cavities. He believed that in cases showing this phenomenon the cancer developed in otherwise normal bronchial mucosa near the cavity and eroded secondarily into the tuberculous lesion. The hypothesis of tuberculosis as a precancerous lesion is largely discredited at this time. Even Ewing in the fourth edition of his text stated that "old tuberculosis was formerly the chief known etiological factor, but is of diminishing importance."

### *3. Cancer predisposes to tuberculosis.*

Because of the known sequence of tuberculosis following cancer, attempts have been made to determine its significance. What little

(10) Cherry, T.: Tubercle bacillus and cancer in mice. M. J. Australia 1: 160-184, Feb. 9, 1929.

(11) Fulton, D., and Rolleston, C.: Bronchial carcinoma in case of pulmonary tuberculosis undergoing artificial pneumothorax treatment. Brit. J. Tuberc. 40: 129-133, Oct. 1946.

(12) Thomsen, G., and Chom, S. A.: Case of primary lung cancer, presumably arisen from old tuberculous cavity. Acta radiol. 26: 230-238, 1945.

(13) Graham, E. A.: Pulmonary tuberculosis combined with carcinoma of lung. J. Missouri M. A. 26: 70-73, Feb. 1929.

evidence is available to support the view that cancer leads to tuberculosis in general in its scope and hard to interpret. Some authors believe that carcinomatous tissue is a good medium for the growth of tubercle bacilli. Others believe that the tissue changes in cancer prepare the road for the invasion of organisms. One frequent observation is that cancer may cause the exacerbation of a known old tuberculosis, but this may be caused by a generally lowered body resistance associated with malignant disease and not a specific biologic process. Fried noted that when tuberculosis follows cancer it is almost always in the same lung. Cruickshank (14) elaborated an involved "Log R law" which he believed demonstrated a causal relationship between cancer and tuberculosis.

#### *4. No specific relationship exists between cancer and tuberculosis.*

Carlson and Bell (9), Fried (8) and others have concluded that the occurrence of combined pulmonary tuberculosis and lung cancer is fortuitous. Although this is a rather negative conclusion, it is consistent with the fact that most people have only one major disease. It is also supported indirectly by the apparent increase in reported combinations of these diseases associated with better diagnosis and more careful autopsy studies, a situation which should not occur if any significant antagonism existed between the disease processes.

### CASE REPORTS

**Case 1.** A 55-year-old man was admitted to this hospital on 12 November 1947. He had malaria in 1916. At the same time he was treated for syphilis and his blood tests had been consistently negative since that time. There was no family history of contact with tuberculosis. In 1919 the patient had blood-streaked sputum, severe productive cough, night sweats, chest pain, anorexia, and weight loss. He was hospitalized at Letterman Army Hospital where a cavity was found in the upper lobe of the right lung, and the diagnosis of tuberculosis established. He left the hospital against medical advice. From that time until his admission to this hospital, he had worked as a cook, stating that he had recurrent episodes of hemoptysis, productive cough, and increase in the previous symptoms for which he was intermittently hospitalized always leaving against medical advice after a short stay in the hospital.

He gave a history of a dull aching chest pain over the entire anterior chest region which at times would radiate to his shoulders and down his left arm and hand for 5 years prior to admission here. The pain was aggravated on coughing and deep breathing. He had frequent frontal and occipital headaches which had become more severe in the 9 months prior to his entry into this hospital. Dizziness and vomiting accom-

(14) Cruickshank, D. B. Topography of relative distribution of cancer and tuberculosis. *Tubercle* 21: 281-291, June 1940.

panied these headaches. The patient had become moderately orthopneic and had recurrent pitting edema of the lower extremities which disappeared on bed rest. Dyspnea on exertion was noted. He also had increasing flatulence, epigastric pain, and constipation for the year prior to his initial admission. His appetite had become increasingly poor for 6 months. There was a history of bright red rectal bleeding.

Just prior to admission he had coughed up a cupful of bright red blood. His cough was productive; he had lost weight, and had anorexia and night sweats. On admission he was noted to be a chronically ill man who appeared older than his stated age. His arteries were palpably sclerotic; his jugular veins were distended. There was a slight thrill over the cardiac apex and a loud systolic murmur heard in the apical area and in the left axilla. There was marked clubbing of the fingers with moderate cyanosis. There was decreased resonance over the left chest from the level of the sixth rib down to the diaphragm posteriorly. There were fine posttussal rales over the apex of the left lung posteriorly and in the left infraclavicular area. The breath sounds in the left axilla were amphoric. The right patellar reflex was hyperactive when compared to the left.

Four sputum specimens were positive for tubercle bacilli shortly after admission. Five 24-hour sputum specimens were studied for tumor cells and none were found. A roentgenogram of the chest showed linear parenchymal infiltration in the superior two-thirds of the right lung with possible cavitation in the supraclavicular region. There was linear nodular parenchymal infiltration involving the entire left lung. There was a cavity 3 cm. in diameter in the lateral apical region of the left lung. Patient was initially treated with absolute bed rest. Shortly following his admission his epigastric pain grew worse. He vomited and because he did not obtain immediate relief he left the hospital against medical advice. He was re-admitted on 14 February 1948 with virtually the same complaint. Streptomycin was given but this was discontinued because of pain at the site of injection. The roentgenogram of his chest is shown in Figure 1. Following this the patient gradually went downhill and on 20 September while semiconscious with no acute respiratory embarrassment and no cyanosis, he died.

On autopsy the marked emaciation was noted. All lobes of both lungs were involved in a fibrocaseous tuberculous process. In addition there was a bronchogenic tumor mass in the left main bronchus and there were numerous tumor masses throughout the left lung (fig. 2). There was an old chronic empyema at the base of the left lung. Metastatic carcinomatous lesions were found in the hilar nodes, liver, and right lobe of the cerebellum. Microscopically there were fibrocaseous and caseo-nodose types of tuberculosis in all lobes of both lungs. Sections of the liver, spleen, and kidneys showed areas of caseation necrosis. Sections of the left lung showed adeocarcinoma and areas of caseation necrosis. There was also a chronic gastric ulcer.



Figure 1 (Case 1). Roentgenogram taken on 17 February 1948 showing scattered productive inflammatory disease bilaterally, the left hilar mass, and the blunting of the left costophrenic angle.

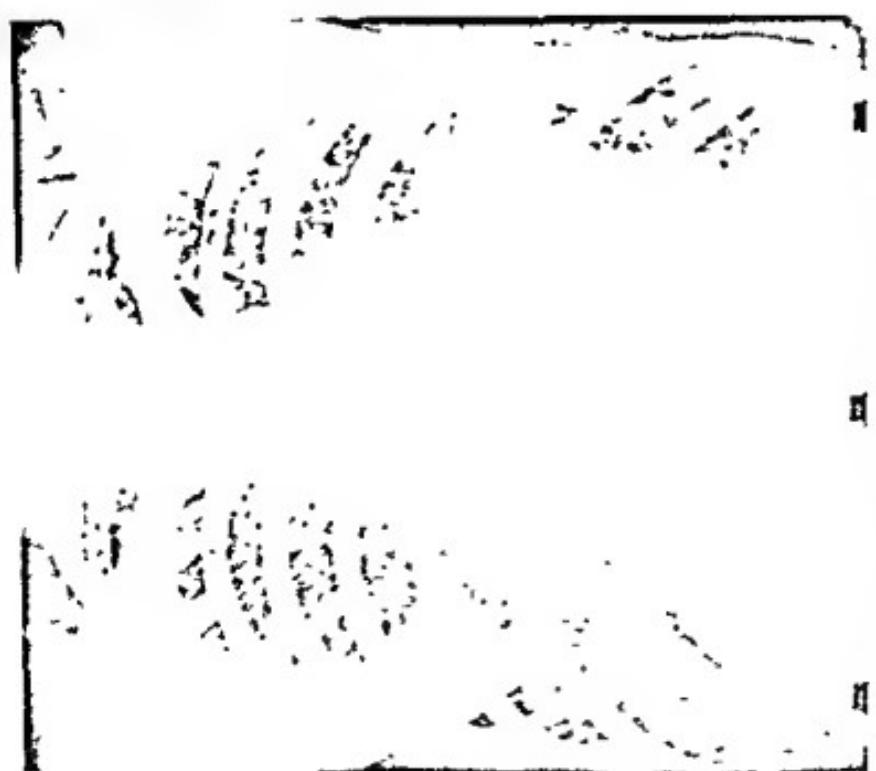


Figure 2 (Case 1). The pathologic specimen showing the centrally located tumor, the scattered tuberculous lesions, and the empyema at the base.

**Case 2.** A 43-year-old man was admitted on 16 February 1950. He had had tuberculosis since 1934 and was admitted to this hospital following a routine roentgenogram which showed some increase in the activity of the disease. The family history revealed no contact with tuberculosis and no history of carcinoma. The patient had been hospitalized from April 1932 to June 1933, following a pulmonary hemorrhage which led to the diagnosis of tuberculosis. He had a therapeutic pneumothorax on the left side from 1933 to 1936. He was hospitalized for 10 days each on three different occasions between 1933 and 1939 for evaluation and was considered to have arrested tuberculosis. Since 1939 he had had 2 roentgenograms yearly until January 1950 when a routine film showed an increase in activity. In the 3 months prior to his hospitalization he noted slight blood streaking of his sputum and slight pain in the right side of his chest.

Physical examination on entry to the hospital showed no abnormalities. After 4 months in the hospital, a single positive gastric culture for acid-fast bacilli was obtained. It was also noted at this time that the lesion in the hilar region had continued to increase in size. Streptomycin and para-aminosalicylic acid therapy was started on 13 June 1950 after the report of the positive culture. Shortly following the initiation of chemotherapy the patient began to have nausea, dizziness, intermittent headaches, vomiting, and inability to flex his neck without pain. The chemotherapy was discontinued but the symptoms persisted. A lumbar puncture showed clear fluid with normal dynamics, but it was noted that the fluid was straw-colored. The symptoms increased and the headache recurred following an initial improvement after the lumbar puncture. Following a neurologic consultation a tentative diagnosis of tuberculous meningitis was made. The second lumbar puncture revealed an increase in the spinal fluid pressure of over 100 mm. of water. The fluid was straw-colored and slightly opalescent. Sugar was reported less than 10 mg. per 100 cc. After a second neurologic consultation the patient was still considered to have tuberculous meningitis. Chemotherapy was again instituted on 27 July. A third lumbar puncture showed the pressure to be over 600 mm. of water with slightly yellow fluid having a ground-glass appearance. On 31 July, 4 days after the start of the second course of chemotherapy, and 3 days after the third lumbar puncture, the patient experienced a sudden change in his sensotium. This was associated with a rise in the systolic blood pressure, a tachycardia, and slow deep respirations. He died on 5 August. The roentgenograms taken in 1932 showed a soft confluent infiltration with cavitation in the upper lobe of the left lung. A pneumothorax was visualized in the roentgenograms taken from 1933 to 1936. In the late 1930's a nodule was noted in the upper lobe of the left lung. This did not change in size. Through the 1940's the roentgenograms showed persistent bronchovascular markings in the left second interspace. These were first noted to be increased on 9 January 1950. By April the increase in the size of the hilar



Figure 8. (Case 4). The pathologic specimen showing the papillary mass in the main bronchi and the scattered fibrous tuberculous lesions.



Figure 7 (Case 4). Roentgenogram taken on 27 July 1941 showing the left apical infiltration and cavitation, and the left hilum enlargement.

was performed and the patient did well for about 1 week postoperatively. On about 1 October a pleural exudate began to form which was treated with frequent aspirations ending in closed drainage and a thoracotomy on 15 October. Following daily irrigation and drainage an open thoracotomy was performed on 27 October, following which the patient showed slight improvement. A wound dehiscence developed subsequent to the open thoracotomy, following which the patient gradually lost weight. He went gradually downhill and died on 26 December. Autopsy and surgical specimen findings included papillary bronchogenic carcinoma of the bronchus of the upper lobe on the left side, small amount of empyema on the left, and chronic active pulmonary tuberculosis of both lungs.

**Case 5.** A 54-year-old man was admitted to this hospital on 23 April 1949. He had had a slight chronic cough for 30 years associated with huskiness of the voice. This remained unchanged until about 2 months prior to admission at which time his cough increased and became productive of about  $1\frac{1}{2}$  cups of sputum per day, which was yellow and occasionally blood streaked. No foul odor was noted. The patient continued to have a feeling of congestion in his chest and generally felt ill. Two weeks prior to admission his temperature rose to  $103^{\circ}$  F. This was slightly reduced with 3 days of penicillin therapy, but returned to  $103^{\circ}$  F. prior to the discontinuance of the penicillin. The patient lost about 10 pounds in the 2 weeks prior to admission.

Physical examination on admission revealed an afebrile man who had apparently lost weight. The abnormal chest findings were limited to the right lung. Generalized arteriosclerosis and an enlarged prostate were also noted. His vital capacity was 3.7 liters or 82 percent of normal. A tuberculin skin test using PPD 1 was positive. Initial sputum cultures showed an abundant growth of *Neisseria*.

Roentgenograms of the chest taken on admission showed a fan-shaped density extending laterally and posteriorly in the region of the right hilar shadow. This was thought to represent segmental atelectasis of one of the basal bronchi of the lower lobe of the right lung. A bronchoscopy was performed on 27 April and a granular lesion which was raised, friable, bled easily, and obstructed one-half of the lumen of the right main bronchus was found immediately below the orifice of the right upper lobe. A biopsy specimen taken at this time showed a squamous cell carcinoma. The roentgenogram taken on 10 May is shown in figure 9. A right pneumonectomy was performed on 11 May. On the twelfth postoperative day the patient developed a bronchopleural fistula which closed after local therapy. On 4 August a first stage four-rib thoracoplasty which was followed 4 weeks later by resection of the sixth, seventh, eighth and ninth ribs, (the fifth rib having been removed at the time of pneumonectomy) was performed. The patient continued to have a small empyema cavity, and a draining sinus which



Figure 10 (Case 5). The pathologic specimen showing the extensive tumor mass.



Figure 9 (Case 5). Rontgenogram taken on 10 May 1949 showing the enlargement of the inferior pole of the right kidney.

had improved by November. In February 1950 the empyema cavity increased in size, the drainage increased in amount, and a bronchopleural-cutaneous fistula was established. Following this the course was progressively downhill and the patient died on 29 May.

The surgical specimen revealed bronchoectatic carcinoma of the squamous cell type probably originating in the posterior segmental bronchus of the lower lobe of the right lung (fig. 11), *carcinosarcoma*, cystic, suppurative throughout both lobes; and healed tuberculosis in the apex of the upper lobe of the right lung.

**Case 6.** A 55-year-old man was admitted to this hospital on 13 October 1950. He had known pulmonary tuberculosis since May 1942 at which time he had symptoms for 1 year. A roentgenogram at that time revealed tuberculosis in the upper lobes of both lungs and the sputum was positive. The patient was hospitalized for 9 months and was then clinically well until March 1950. He then developed increased symptoms, roentgenographic signs of cavitation, and blood-streaked sputum which was positive for acid-fast bacilli. Physical examination revealed a chronically ill man with temperature of 99.6° F. and a pulse of 110. Abnormal physical findings were limited to the chest. His sedimentation rate was 38. Sputum smears and cultures were positive for acid-fast bacilli. Roentgenograms taken on admission revealed linear and nodular parenchymal infiltrates in the upper lobe of the right lung most marked in the apex and first interspace anteriorly with evidence of cavitation in the region of the first interspace on the right. Productive inflammatory disease was also visualized in the midportion of the left lung extending outward from the hilar region. An ECG taken on 24 October revealed incomplete right bundle branch block. The vital capacity on 21 November was 4.2 liters or 96 percent of normal. A bronchoscopy on 6 November revealed an unsuspected squamous cell carcinoma in the anterior division of the bronchus to the lower lobe of the right lung. The roentgenogram taken on 2 December is shown in figure 11. The patient was seen by the Tumor Board and Chest Surgical Review Board and a right pneumonectomy was performed on 12 December. The postpneumonectomy thoracoplasty was not completed because of repeated episodes of hypotension associated with the induction of anesthesia. A right phrenemphraxis was performed on 29 January 1951. Four months later the patient was doing well. Examination of the surgical specimen revealed squamous cell carcinoma of the anterior division of the lower lobe and active tuberculosis in the apex of the right lung (fig. 12).

**Case 7.** A 51-year-old man was admitted to this hospital on 4 January 1950. He became concerned about his health in April 1949 because he had recently lost 40 pounds. The examination in a station hospital overseas in May 1949 including roentgenograms of the chest did not reveal any cause for his loss of weight. He returned to the United States and on a routine re-enlistment physical examination on 16

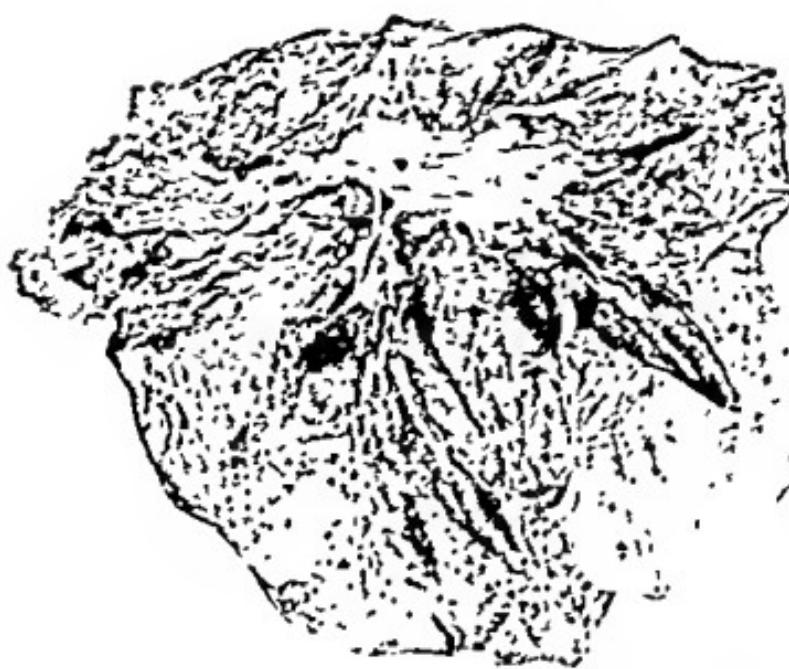


Figure 12 (Case 6). The pathologic specimen showing a large, callosus lesion in the apex and the carcinoma to the bronchus to the lower lobe of the right lung.



Figure 11 (Case 6). Roentgenogram taken on 2 December 1950 showing the infiltration and cavitation to the apex of the right lung and small subpleural lesion to the right hilum.

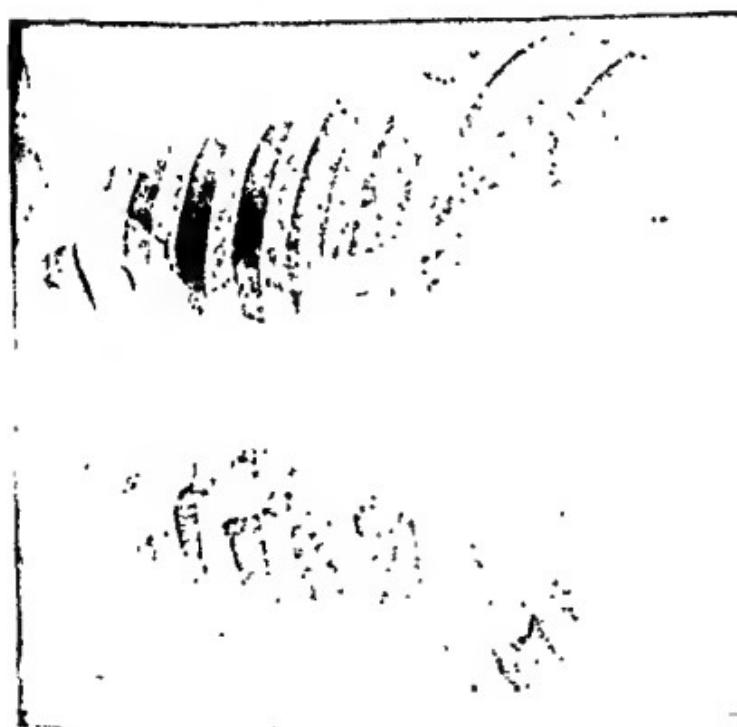


Figure 13 (Case 7). Roentgenogram taken on 4 January 1950 showing a nodular lesion under the second rib anteriorly which proved to be a carcinoma.



Figure 14 (Case 7). The pathologic specimen showing the carcinoma. The tuberculous lesion is not visualized (a) Apical bronchus (b) Posterior lateral bronchus, (c) Tumor, (d) Antero-lateral branch.

December a roentgenogram was taken which revealed a lesion in the right lung. The only symptoms referable to the respiratory system were a chronic cough of many years' duration productive of small amounts of mucoid material most easily raised in the early morning. His father died of carcinoma of the prostate.

Physical examination on admission revealed loss of weight and a slight decrease in the breath sounds associated with fine crepitant rales over the right hemithorax posteriorly. There was also a slightly red, tender area 3 mm. in diameter over the occiput.

TABLE I. Comparison of seven patients with tuberculosis and carcinoma of the lung

	Patient						
	1	2	3	4	5	6	7
Age (years)	55	43	56	50	54	55	51
Tuberculosis diagnosed ante mortem	Yes	Yes	Yes	No	No	Yes	*
Known duration of tuberculosis (years)	28	18	28	Unknown	Unknown	8	Unknown
Tuberculosis active at death	Yes	No	No	Yes	No	Patient living**	Yes
Carcinoma diagnosed ante mortem	No	No	Yes	Yes	Yes	Yes	*
Both conditions diagnosed ante mortem	No	No	Yes	No	No	Yes	**

\*Strongly suspected and used as clinical diagnosis in spite of absence of bacteriologic or pathologic proof.

\*\*Tuberculosis active

The sputum and gastric washings were repeatedly negative for acid-fast bacilli. A tuberculin skin test using PPD 2 was positive. Roentgenograms taken on admission revealed a rounded area of increased density with a well-circumscribed margin 3 cm. in diameter adjacent to the superior pole of the right hilus, which appeared, on the lateral projection, to lie in the posterior segment of the upper lobe of the right lung (fig. 13). Because of the linear densities extending from this region to the apex, the initial impression was probable pulmonary tuberculosis. A bronchogram showed obstruction of the apical bronchus and the possibility of bronchogenic carcinoma could not be excluded. Bronchoscopy on three different occasions revealed a normal tracheobronchial tree. A pneumonectomy was advised and was performed on 10 March 1950. The patient developed a bron-

chopleural fistula on the eighteenth postoperative day. Open drainage of the right hemithorax was performed on the thirtieth postoperative day but the patient did not do well. On 25 May the lesion on the scalp over the occiput was excised and was shown to be an anaplastic squamous cell carcinoma. On 10 June following continuous profuse drainage of the sinus tract, hard subcutaneous nodules were noted over the anterior aspect of the right arm and anterior aspect of the thoracic wall. These were diagnosed as metastatic tumor nodules similar to that excised from the scalp. The course was rapidly downhill and the patient died on 6 July.

Examination of the pathologic specimen obtained at operation revealed bronchogenic carcinoma of undifferentiated type in the apical bronchus to the upper lobe of the right lung (fig. 14). There was also active pulmonary tuberculosis in the apical segment. Metastases had occurred to the regional nodes, the right occipital area of the scalp, and to the anterior aspect of the chest wall on the right.

A comparison of the cases reported is summarized in table 1.

#### DISCUSSION

These patients fall within the age group in which carcinoma of the lung is most commonly found. In the 4 patients whose tuberculosis was diagnosed bacteriologically ante mortem, the long duration of the disease is of interest. In 2 of these the chronicity of the disease and the knowledge of its existence may have delayed the diagnosis of carcinoma because of the suspicion of reactivation of the tuberculosis which in reality had not occurred. One patient whose carcinoma was discovered accidentally was living and well 4 months after pneumonectomy.

Inasmuch as a clinical possibility exists for combined tuberculosis and cancer of the lung, one should not hesitate to suspect one disease even after the diagnosis of the other is made. The plea must be made to think of cancer in patients with pulmonary tuberculosis. The finding of acid-fast bacilli in a patient with known cancer is another problem. Suffice it to say that many saprophytic acid-fast bacilli have been found in carcinomatous tissue both clinically and at autopsy. The need for their differentiation in a laboratory must be kept in mind. Drymalski and Sweany (15) reported that in 10 of 15 patients with carcinoma showing acid-fast bacilli the latter were of secondary or minor importance.

One should be suspicious of inconsistencies in the symptomatology, clinical course, or findings, especially in tuberculous patients (16, 17).

(15) Drymalski, G. W., and Sweany, H. C.: Significance of pulmonary tuberculosis when associated with bronchogenic carcinoma. *Am. Rev. Tuberc.* 58: 203-206, Aug. 1948.

(16) Gerstl, B.; Wassing, F. C., Jr.; and Howlett, K. S., Jr.: Cancer and pulmonary tuberculosis; diagnostic problems in patients with cancer of lung in presence of pulmonary tuberculosis. *Am. Rev. Tuberc.* 54: 470-487, Dec. 1946.

(17) Sheftz, L. M., and Hentel, W.: Bronchogenic carcinoma and pulmonary tuberculosis. *Am. Rev. Tuberc.* 61: 369-386, Feb. 1950.

The symptoms of tuberculosis and cancer of the lung are so similar as to be of no differential diagnostic significance, but the following should lead one to suspect cancer: (1) The absence of readily demonstrable bacilli on adequate repeated sputum examination in patients with florid exudative pulmonary disease; (2) roentgenographic progression of the disease, especially the development of atelectasis, with apparent clinical and laboratory improvement; (3) change in the character of a patient's cough, especially with a lack of sputum production; (4) change in the character of the sputum produced; and (5) development of wheezing with otherwise apparent clinical improvement. The importance of accurate and complete diagnosis cannot be underestimated in view of the greatly improved therapeutic (especially surgical) techniques now available to us.

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## BOOK REVIEW

*The Public Health Nurse and Her Patient*, by Ruth Gilbert, Coordinator, Course for Mental Hygiene Consultants and Assistant Professor of Nursing Education, Teachers College, Columbia University. 348 pages. Published for The Commonwealth Fund by Harvard University Press, Cambridge, Mass., 1951. Price \$3.75.

This text should be welcome to all nurses, and especially to the public health nurses who are familiar with the first edition of this book. The problems frequently encountered by the public health nurse are illustrated by numerous examples and by excerpts from case records. The need for, and the recognition of, emotional growth and maturity and its effect on the nurse's attitude, as well as that of the patient and the family, are clearly described. Every aspect of nurse-patient relationship, including the weak and strong points of public health agencies as influenced by the absence or presence of agency flexibility, appears to be brought out in this text. The recognition of the importance of individual needs and individual differences are not overlooked by the author. The nurse is reminded of the necessity to avoid attempting to mold the patient to the nurse's standards. The simplicity of language and the general style of writing make the book unusually readable. A selected bibliography is provided. In no way could the publisher's comment, "This book should be of value to public health nurses, to social workers, and to nurses in general" be interpreted as an overstatement. Every nurse who seeks workable information in preference to impractical theory would be glad to have this book in her reference library.

—Lt Comdr. G. E. Dvorak, NC, U. S. N.

# Cold Injuries With Emphasis on Frostbite

Preliminary Report II

Kenneth D. Orr, Lieutenant Colonel, MC, U. S. A.

David C. Fainer, Captain, MC, U. S. A.

**O**N 1 December 1950 at this hospital a Cold Injury Section was established for the study and treatment of patients with frostbite and other types of cold injury which were received during the Korean conflict. From 1 December 1950 to 1 April 1951, 4,216 patients were admitted to this hospital with a diagnosis of a cold injury. Most of them were ground troops with the so-called ground-type frostbite. Eighteen percent were transfected to hospitals in the Zone of the Interior between 1 December 1950 and 1 May 1951. At the close of the winter months summaries of the clinical records of 1890 patients who had incurred frostbite were available for analysis. About 86 percent of the cases involved the feet alone; 11 percent the hands and feet; 2.5 percent the hands alone; and 0.5 percent other sites.

Most of the cases occurred as the result of a tactical situation in which the soldier was immobilized for from 2 to 24 hours by enemy action, with the ambient temperature ranging from 20° to minus 30° F. Wet feet, inadequate protection and exhaustion were important in some, but not all cases. Severe climatic conditions and immobility for several hours appear to be the most important factors in the production of ground-type frostbite.

Much of our knowledge regarding the physiopathology of frostbite has come from experimental frostbite in laboratory animals. These lesions usually have been produced by immersion of the foot or ear of a rabbit into alcohol with a temperature of from minus 10° to minus 55° C. for a few minutes. The time sequence of frostbite in the rabbit foot or ear is shorter than in ground-type frostbite observed in human beings. Furthermore, there is frequently a sharp line of demarcation

(1) Work done at Osaka Army Hospital, Japan. This paper was presented 14 June to Military Medical Section, American Medical Association, Atlantic City, N. J.

of the frozen part of the rabbit when the injury is produced by immersion, whereas there is a gradation of the severity in human frostbite. The distal parts are more severely frostbitten than the proximal parts. Experimental frostbite is a "quick freeze," while human ground-type frostbite is a "slow freeze." Nevertheless, the events which occur in experimental frostbite are qualitatively, if not quantitatively, similar to human ground-type frostbite.

Frosting destroys some tissue (2, 3) but the tissue cell destruction is not caused by the freezing alone for a large part of the damage may be secondary to certain vascular changes (4-8). As long as the tissue is frozen, there is no movement of blood. After rewarming, blood again flows freely into the frozen part. The freezing causes damage to the walls of the small blood vessels. The permeability of the capillaries is increased and fluid escapes from the vessel lumen. This process begins in less than 3 hours after rewarming in human beings. Vesicles and bullas appear within from 6 to 24 hours and contain fluid which is similar to the plasma. It becomes partially coagulated after a few days and on analysis of the fluid remaining, after from 5 to 8 days, from 3.7 to 5.2 grams of protein per 100 cc. is found with an albumin-globulin ratio of 3:1. The chlorides in the fluid range between 514 and 710 mg. per 100 cc.

Local hemococoncentration results from the leakage of fluid from the vessels of the frostbitten part. This phenomenon of local hemococoncentration is described variously as silting, sludging, and conglutination. This phenomenon results in stasis of blood flow which may be partly responsible for the subsequent necrosis of tissue. From 2 to 3 days after being severely frostbitten, patients will manifest cold toes as the result of decreased or absent blood flow. It has been impossible to produce warmth of cold parts by the use of sympathetic ganglion blocks or vasodilators.

Friedman et al. (6) described the conglutinated cells becoming organized into "agglutinative thrombi." Secondary or ascending throm-

(2) Lake, N. C.: Investigation into effects of cold upon body. *Lancet* 2: 557, Oct. 13, 1917.

(3) Pichotka, J.; Lewis, R. B.; and Freytag, E.: Sequence of increasing local cold injury USAF School of Aviation Medicine, Project No. 21-23-006, Report No. 6, March 1951.

(4) Kreyberg, L.: Development of acute tissue damage due to cold. *Physiol. Rev.* 29: 156, 1949.

(5) Greene, R.: Immediate vascular changes in true frostbite. *J. Path. & Bact.* 55: 255-267, July 1943.

(6) Friedman, A. B.; Lange, R.; and Werner, D.: Pathology of experimental frostbite. *Am. J. M. Sc.* 213: 61-67, Jan. 1947.

(7) Quintanilla, R.; Krusen, F. H., and Essex, H. E.: Studies on frostbite with special reference to treatment and effect on minute blood vessels. *Am. J. Physiol.* 147: 149-161, Apr. 1947.

(8) Fishman, F. A., and Crismon, J. M.: Studies on gangrene following cold injury: general course of events in rabbit feet and ears following untreated cold injury. *J. Clin. Investigation* 23: 235-244, Mar. 1942.

bosis may occur to produce a further loss of adjacent tissue. Specimens removed at this hospital and elsewhere weeks or months after freezing showed adherent thrombi of all vessels.

The simplest classification divides frostbite into 4 degrees of severity. These divisions cannot be made in the first few hours after rewarming because most lesions have a similar appearance at that time. The differentiation can seldom be made until 24 or more hours have elapsed. All degrees of frostbite may be present in a single extremity. The most distal part of the extremity is usually the most severely damaged.

*First degree frostbite* (table 1) is characterized by numbness, swelling, and erythema of the involved part. In some cases desquamation may occur later. Many men with first degree frostbite were not evacuated.

TABLE 1. *Characteristics and incidence of each degree of frostbite in 1,880 patients*

Degree	Characteristics	Incidence (percent)
First	Numbness, swelling and erythema. No vesicles. Superficial desquamation in some cases.	16.7
Second	Partial skin thickness vesiculation.	33.6
Third	Involvement of entire thickness of skin and varying depths of subcutaneous tissue. Vesiculation may or may not be present.	43.6
Fourth	Involvement resulting in loss of the part.	6.1

*Second degree frostbite* (table 1) produces vesiculation of the skin. This involves only partial skin thickness. When the vesicle is shed, the underlying area is epithelialized and ulceration into subcutaneous tissue is absent. The most common sites for this degree of injury have been the distomedial portion of the great toes, the lateral aspect of the fifth toes, and the dorsum of fingers.

*Third degree frostbite* (table 1) involves the entire thickness of skin and varying depths of subcutaneous tissue. The most common sites for this degree of injury are the great toes, second toes, heels, and tips of the fingers. A vesicle may or may not develop at the site of injury. If a vesicle does form, its wall is much thicker than that found in second degree frostbite. In third degree frostbite, the lesion may be a small area of full-skin-thickness damage at the center of a vesicle on a toe, or it may involve the skin and subcutaneous tissue of an entire digit.

In fourth degree frostbite (table 1) the injury extends through the entire thickness of the part, including bone. Fourth degree frostbite results in the loss of an extremity or part of it. The most common sites for this injury have been digits or the distal third of the foot. Thin-walled bullas are commonly present over the dorsum and sole of the foot at the proximal periphery of the severely injured part. The position of the bulla is of prognostic significance, usually indicating severe damage to tissue distal to it. Few or no vesicles are seen on the distal portions of the toes or parts which have incurred fourth degree frostbite. Edema of the entire part occurs, developing within 3 hours after thawing. Parts which become cold and remain cold will be lost despite any therapeutic measure.

### CASE REPORTS

**Case 1.** A soldier was frostbitten on the night of 13 January 1951. On 14 January a vesicle had formed on the left great toe. By the twelfth day after injury, the vesicle had completely collapsed and dried, forming a hard, brown-black eschar. Twenty-four days after injury, the eschar came off revealing a thin, violer, intact skin. This lesion was second degree frostbite and was differentiated from third degree frostbite by the absence of an ulcer extending into subcutaneous tissue after the eschar was removed.

**Case 2.** A soldier was frostbitten on the night of 13 January 1951. On 14 January vesicles were present on the left first and second toes. Three days after injury slight edema was present over the dorsum of the left foot. Large vesicles were present on the left first and second toes. Erythema proximal to the vesicles was present. On the twelfth day the vesicles had enlarged and were tense. Erythema and tenderness were still present proximal to the vesicles. The vesicles became softer and developed a deep purple color. Seventeen days after injury the second left toenail was débrided. By the thirty-third day the vesicle of the left great toe had dried into a hard, black eschar. Because of purulent drainage the eschar on the left great toe was débrided on the forty-second day, exposing a granulating area. This granulating area re-epithelialized slowly and resulted in scarring and induration of the involved toes. This was a third degree frostbite.

**Case 3.** A soldier became frostbitten on the night of 3 January 1951. On 4 January, following removal of his boots, his feet swelled to such an extent that he was unable to replace the boots. Six days after injury he complained of shooting pain in the feet. There was marked pitting edema of the feet and ankles (fig. 1). The distal two-thirds of the feet were cool to touch although the pedal pulses were strong. Ten days after injury the edema had subsided. Fourteen days after injury extensive wet necrosis of the superficial tissue was present at the base of the third and fourth toes on the dorsum of the left foot. By the fortieth day after injury (fig. 2) many toes had become mummified.



Figure 1 (case 3). Showing fourth degree frostbite of the toes of both feet 6 days after injury. Figure 2 (case 3). Showing mummification of the toes and extensive wet necrosis 40 days after injury. Tendons are exposed on the right. Figure 3 (case 3). Showing clean granulation tissue following amputation. Skin grafts were applied later.

Large wet necrotic areas extended across the dorsum of both feet. A putrefactive odor was present. Tendons leading to the right second, third, and fourth toes were exposed. The patient's daily temperature ranged from 98.6° to 99.4° F. Slightly tender, moderately enlarged lymph nodes were present in each femoral triangle. Forty-three days after injury all toes except the left fourth and fifth were removed. Eight days after operation (50 days after injury) (fig. 3) healthy granulation tissue was present and no odor of putrefaction remained. Skin grafts were necessary to complete the treatment after which the patient was able to walk again.

### DISCUSSION

All fourth degree frostbite does not have a course similar to that of case 3. Wet gangrene may not develop. The parts may merely dry and mummify. A definite line of demarcation exists. These patients received general symptomatic and local care. No therapeutic agent or procedure alleged to influence the course of frostbite was used and they represent examples of a control group.

The treatment of frostbite, as observed in the Korean conflict, should be divided into three overlapping phases. The *first phase* deals with the management of the patient in the forward areas of the combat zone. Any constrictive clothing should be removed from the site of injury. If the lesion involves the feet, the patient should be carried on a litter. Rewarming of the lesion remains a problem; all possible methods are advocated in the literature. Recent experimental work (9-12) has indicated that quick rewarming in rapidly frozen animal parts lessens the eventual damage produced. Whether this can be applied to the ground-type, slow freeze is unknown. Only 2 percent of patients with frostbite in Korea were seen at battalion aid stations before edema and vesicles had appeared. Because of this, and since proper facilities were not available, rapid rewarming was not used.

Local care of the lesion in the forward area is directed toward the protection of intact vesicles and bullas. As a rule, those patients in whom the vesicles or bullas were completely denuded or drained arrived in the hospital with infected lesions. Protection of the lesion by wrapping loosely in blankets or a loose dry dressing, being sure that body warmth was maintained, is advised. Those patients who had a vaseline

(9) Arev, T. Y.: Question of slow or rapid warming of frozen extremities. *Vestnik Khir.* 57: 527-535, May 1939.

(10) Fuhrman, F. A., and Crierton, J. M.: Studies on gangrene following cold injury: treatment of cold injury by means of immediate rapid warming. *J. Clin. Investigation* 26: 476-485, May 1947.

(11) Lempke, R. E., and Shumacker, H. B., Jr.: Studies in experimental frostbite: evaluation of several methods for early treatment. *Yale J. Biol. & Med.* 21: 231-234, Mar. 1949.

(12) Pichotka, J., and Lewis, R. P.: Effect of rapid and prolonged rewarming on local cold injury. *U. S. Armed Forces M. J.* 2: 1293-1310, Sept. 1951.

pressure dressing applied in the forward area hospitals showed a greater amount of infection and lost an equal or greater amount of tissue.

The second phase of treatment deals with the patient in a hospital. Strict bed rest is necessary until the vesicles or bullas have dried. The duration of bed rest depends on the severity of the lesion. Edema usually is present in severe third and fourth degree lesions, particularly in those of the lower extremities. At this hospital it was found that the edema subsided more rapidly when the foot of the bed was elevated 5 inches.

A ward temperature between 70° and 78° F. was found to be the most satisfactory. Higher and lower ward temperatures increased the degree of pain in the injured part. Sheets and blankets at the foot of the bed were folded back 18 inches so that frostbitten feet were exposed at all times. Under these conditions pain was not a serious problem and narcotics were seldom required.

Various agents and procedures which affect the peripheral circulation have been advocated in the treatment of frostbite. Vasodilator agents and sympathetic ganglion blocks with procaine or with absolute alcohol were begun from 2 to 15 days after injury. The course of the injury was not favorably influenced when the results were compared with the control group.

Lange et al. (13) found that the degree of damage was greatly reduced when heparin was administered to experimentally frostbitten animals, although others (7, 14, 15) have been unable to confirm this observation and still others have had only partial success (16). Heparin was given intravenously in amounts sufficient to maintain the clotting time (Lee-White) above 20 minutes, beginning from 36 hours to 10 days after injury. The results seem favorable when compared with the control group. Wet gangrene did not occur as it did in some patients in the control group and in some in whom vasodilatation was produced. The lesions dried and mummified and surgical therapy was not necessary until a definite line of demarcation appeared. In a few patients with apparent fourth degree frostbite, in whom anticoagulant therapy was started less than 3 days after injury, the degree of damage was less than predicted.

An attempt was made to reduce surface bacteria by daily cleansing with a mild, colorless antiseptic solution (1:1000 zephiran chloride).

(13) Lange, K.; Weiner, D.; and Boyd, L. J.: Frostbite; physiology, pathology and therapy. *New England J. Med.* 237: 383-389, Sept. 11, 1947.

(14) Pichotka, J., and Lewis, R. B.: Use of heparin in treatment of experimental frostbite. *Proc. Soc. Exper. Biol. & Med.* 72: 130-136, Oct. 1949.

(15) Fuhrman, F. A., and Crismon, J. M.: Studies on gangrene following cold injury; effect of rutin and other chemical agents on course of experimental frostbite in rabbits. *J. Clin. Investigation* 27: 364-371, May (pt. II) 1948.

(16) Finneran, J. C., and Shanacker, H. B., Jr.: Studies in experimental frostbite; further evaluation of early treatment. *Surg., Gynec. & Obst.* 90: 430-438, Apr. 1950.

Vesicles were left intact until they ruptured spontaneously, at which time they were débrided.

The third phase of treatment deals with local foot care and the prevention of infection. It is similar to the treatment of any wound or traumatized part, regardless of cause. This requires débridement of loose, necrotic tissue, cleansing of suppurative parts, and the administration of antibiotics as indicated.



Figure 4. Showing an apparent line of demarcation through the distal third of the foot 15 days after injury. Figure 5. Same patient as shown in figure 4. Tissue is normal except for the great toe, 20 days after injury, and following superficial débridement.

At this hospital, penicillin was given to all patients with frostbite severe enough to produce vesicles. Other antibiotics were given when organisms not sensitive to penicillin were present. Superficial débridement was performed frequently. Cleansing was accomplished by soaks in a solution consisting of equal parts of 1:1000 aqueous zephiran chlotide and 3 percent hydrogen peroxide, or in normal saline solution followed by wet zephiran-peroxide dressings for from 6 to 8 hours. Frostbitten parts were left exposed to the air when soaks or wet dressings were not being used.

Emergency amputations are seldom indicated in frostbite, except in patients showing extensive putrefactive gangrene associated with lymphadenopathy and signs of general sepsis. It is desirable to allow a definite line of demarcation to appear in order to preserve the greatest possible amount of tissue and attain maximum function. An apparent line of demarcation may be seen early, but débridement may reveal that the proximal part of the apparently necrotic tissue is superficial, with normal tissue below. This is illustrated in figures 4 and 5. Tissue distal to a definite line of demarcation will be dry, black, and shriveled or mummified.

#### SUMMARY

Most patients with cold injury incurred in the Korean conflict during the winter of 1950-51 were ground-type frostbite. In 86 percent of these patients the feet, in 11 percent the hands and feet, in 2.5 percent the hands alone, and in 0.5 percent other sites were involved. The treatment of ground-type frostbite can be divided into 3 overlapping phases. Future experimental work will have to be modified more closely to simulate ground-type frostbite occurring in human beings before final conclusion regarding treatment may be made.

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#### BOOK REVIEW

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*Social Aspects of Illness*, by Carol H. Cooley, Director of Social Service, The Presbyterian Hospital, Chicago; with a foreword by Edna S. Newman. M. A., R. N. 305 pages. W. B. Saunders Co., Philadelphia, Pa., publishers, 1951. Price \$3.25.

The nurse must be able to recognize such social factors in illness, as housing, unemployment, rehabilitation, and community resources. She must appreciate their significance and know how the patient can obtain help. Special problems presented by various age and diagnostic groups are also discussed in this book. Team relationships are stressed through the use of practical, rational explanations of the role of the nurse in collaboration with the social worker. This book should be a valuable aid to the student nurse in making the application to situations found in the hospital, out-patient department, and the community.

—Lt. R. M. Hutchinson, NC, U. S. N.

*A Textbook of Medical Conditions for Physiotherapists*, by Joan E. Cash, B. A., M. C. S. P. (Teachers' Certificate), with a foreword by Frank D. Houltt, C. V. O., M. A., M. D., F. R. C. P. 350 pages; illustrated. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1951.

This book is a supplementary guide to a physical therapy text. It should assist the student as well as the graduate physical therapist

The paraffin and other wax treatments so popular in the past use the same principle as is involved in the method under discussion, i. e., an effective occlusive dressing which keeps contaminants out and vital fluids and tissue components in, where they can aid the healing process. The objection to this method of treatment is the technical difficulty in its application and the necessity for frequent removal and reapplication. It, too, is apt to crack and separate and thus permit weeping. Frequent redressing exposes the wound to infection. The method about to be described overcomes most of these objections and is believed to represent a real improvement in the treatment of burns.

In March 1951 this hospital, among others, was designated to make a field trial of a new local treatment for burns. This paper constitutes the report of 22 patients treated by this method. Our experience to date, although limited, has been encouraging. Those of us who have used it believe that this treatment is the best local treatment for burns and that it offers these advantages:

1. It is quickly and easily applied.
2. Its application can be readily mastered by nonprofessional people.
3. It requires about one fifth the storage space which would be required for a comparable pressure dressing.
4. Amelioration of pain is marked and rapid.
5. The loss of body fluids from the wound is eliminated and tissue edema is minimized.
6. The dressing forms an impervious semiflexible coating which adheres firmly to living as well as devitalized cells, thus preventing further contamination and minimizing infection.
7. It applies an inherent local pressure, thus further minimizing edema.
8. Although the dressing is stiff enough to provide some splinting of the injured parts, it has enough flexibility because of its small bulk to allow the patient to care for himself.
9. The patient's own proteolytic enzymes and other phagocytic elements are retained at the site of injury, where they usually accomplish a prompt and complete débridement without infection so that skin grafting of the third degree burned areas is usually possible at the time of the first dressing, from 10 to 14 days after injury. In severe burns with much tissue necrosis this accumulation of phagocytic and lytic agents under the dressing often gives the appearance of infection, but smear and culture of this material usually fails to reveal organisms, and the facility with which split thickness grafts can be applied to these areas after thorough cleansing with G-11 soap proves that gross infection is not present.

10. It is suitable for any part of the body.
11. It is well adapted for the mass treatment of burns.
12. The prevention of further contamination and the patient's self-reliability make it ideal where transportation is required after the primary treatment.

The principle of this new method is not new, but the method and application are. It was developed over a period of 10 years by Dr. Raymond M. Curtis and his associates. Two materials are used. The first is a gel composed of partially hydrolyzed casein, sodium lactate, and sodium lauryl sulfate. This mixture after sterilization is a neutral gel about the consistency of molasses. It has been stored for several years with no deterioration. Freezing does not affect it. The second part of the dressing is a four-ply, coarse-meshed gauze, impregnated with zinc acetate (2).



Figure 1. Initial dressing of third degree burn of leg. (Photograph by courtesy of Curtis, Brewer, and Rose.)

Without débridement other than evacuating large blisters and the aseptic removal of loose necrotic skin, the gel is spread over the entire burned area with a wooden spatula under sterile precautions. The gel is applied evenly, about  $1/16$ -inch thick. The impregnated gauze is then laid over the gel and pressed down so the gel thoroughly penetrates the meshes of the gauze (fig. 1). The gauze is applied lengthwise and not circularly on the extremities. It is tailored to fit the burned areas smoothly. (An alternate method is to spread the gel on the impregnated gauze and then lay the gauze "butter side down" over the burn.) The dressing is then secured with an elastic bandage, not with the idea of exerting pressure but to assure firm apposition of the dressing while it is setting. On the face and head, the elastic

(2) These materials are packaged together as ZINAX.

bandage is omitted, but greater care must be exerted to see that the gel impregnates the meshes of the gauze completely. The gel will set without the zinc acetate gauze, and is occasionally so used on the face and neck, but setting is accelerated when the gauze is used. The fingers are bandaged individually when burned, to allow some activity and add to the patient's self-reliability.

Following the application of the dressing, the gel sets in a few minutes. Within a few hours the burn is covered with an adherent, impervious, protective membrane which will allow no molecule larger than water to pass through. This membrane produces pressure over the burned area by fixing each cell to the position it occupied when the gel set. The body's own phagocytic and reparative agents are retained at the site of injury, where they are needed, and as a result first and second degree burns are practically always healed when the dressing is first removed in from 10 to 14 days, and the areas of third degree burn are usually self-débrided and ready for grafting at this time (fig. 2). It is customary to remove the first dressing in the operating room, with all preparations made for skin grafting. The devitalized tissue usually lifts off with the dressing. Soaking in warm water will soften the dressing and facilitate the removal if it is too adherent. The third degree areas appear as clean subcutaneous fat, to which split grafts of from 0.0012 to 0.0014-inch readily adhere and grow (fig. 3). This experience is the rule where the gel can be applied within the first few hours after injury. If a pressure dressing with or without vaseline has been applied, this is removed and the vaseline cleaned off with dry gauze or ether before the gel is applied. Then there has been delay in the application of the gel, increased opportunity for contamination exists, and in some of these patients we have observed mild infection which has delayed grafting for a few days. In



Figure 2. Same burn 18 days after injury, following removal of dressing in operating room, and showing burn tissue completely lysed exposing subcutaneous fat. The complete area was covered with dermatome skin grafts on the eighteenth day. (Photograph by courtesy of Curtis, Breuer, and Rose.)



Figure 3. Final result 6 months after skin grafting of the same burn. (Photograph by courtesy of Curtis, Brewer, and Rose.)

the patients dressed promptly after injury we have observed no infection.

The experience of others using this treatment parallels our own. Curtis et al. (3), the originators, in presenting this treatment to the 1951 meeting of the American Medical Association, reported its use in 115 cases. They state: "The results obtained in burns with this treatment for ambulatory as well as hospitalized patients have been most gratifying." They called attention to the work of Glenn et al. (4), who demonstrated the part played by tissue edema in the production of fibrosis associated with burns, and also the fact that this edema and fibrosis could be prevented by encasing burned extremities in plaster casts. They (Curtis et al.) stated: "The ability of the protein film to adhere to the injured surface provides a type of immobilization and tissue support which cannot be accomplished by the usual pressure dressing. Clinically and experimentally, we have found that this dressing diminishes superficial loss of fluid as well as the loss of protein into the burned area. We have been repeatedly impressed in our clinical cases with the ability of this dressing to prevent blistering in the superficial burns and edema of the injured parts in the extensive ones."

For a comparison of the open treatment with the use of a zinax dressing in a rabbit see figure 4. Both the animal's forelegs were exposed to 100° C. for 30 seconds. One foreleg was immediately dressed with a zinax burn dressing. Then the dressing was removed 5 days later the leg showed no swelling and partial débridement had occurred. In the other foreleg, which had been exposed to the air,

(3) Curtis, R. M., Brewer, J. H., and Rose, I. W., Jr.: New technique for local treatment of burns. *J. A. M. A.* 147: 741-743, Oct. 20, 1951.

(4) Glenn, W. V. L., Gilbert, H. H., and Drinker, C. K.: Treatment of burns by the closed-plaster method, with certain physiological considerations implicit in success of this technique. *J. Clin. Investigation* 22: 609-625, July 1943.



Figure 4. The extremity on the left was immediately dressed with zinax burn dressing which extended 1 inch above the burn. The extremity on the right received no dressing (open treatment). This photograph was taken 5 days after injury. (Photograph by courtesy of Curtis, Breuer, and Rose.)

swelling extended well above the upper margin of the burn and separation of the necrotic skin had not yet started.

Fleischer (5) has treated 447 burns by this method; 359 were thermal, 67 were friction, and 21 were chemical burns. About 33 percent were first degree and the rest were second and third degree burns. He reported a decrease in the number of dressings required, better results with less scarring, the patients were comfortable during treatment, and, most important of all, none lost time from work. Fleischer continued with zinax dressings until the burns healed; even those which were third degree were not grafted. He reported better results with less scarring and stated: "We believe this treatment has worked as well with minor as with major burns, and it represents a better method than those formerly available for the treatment of the industrial burn."

(5) Fleischer, W. E.: Personal communication.

Firor (6), who has had wide experience with all recommended methods of treatment, in discussing Curtis' presentation of this subject said: "During the past 30 years we have come a long way in understanding the altered physiology of the burned patient. As a consequence, our treatment of the burned patient has improved enormously, but our treatment of the burned area has not shown similar improvement. \* \* \* We have made very little progress until the work which has just been presented. \* \* \* It is my firm conviction that the method described by Curtis and Brewer today is unquestionably the best that has been developed. Having watched the evaluation of their method, and having used it at the Maryland General Hospital, I can say that it is far superior to all others. I wish to take this opportunity to confirm the claims made by the authors concerning its efficacy, and to congratulate them on their persistence in developing it."

We have treated 22 consecutive burns by this method. The more severe and complicated cases are reported in detail. The rest are grouped together, as none had third degree burned areas and all were healed without scarring when the first dressings were removed from 6 to 12 days after injury.

#### CASE REPORTS

**Case 1.** An 8-month-old boy received extensive second and third degree burns involving 50 percent of his body surface as well as burns of the mouth and nasopharynx. Zinax was applied at once and vigorous supportive measures were instituted, including 10 mg. of ACTH q. i. d. The child was critically ill and in spite of what appeared to be an adequate electrolyte and fluid balance he died with pulmonary edema 1 week after injury. Therefore the value of zinax in this case could not be determined but the dressing was still firmly adherent at the time of death. There was no evidence of infection of the burned areas. There had been no fluid loss of any consequence from these burns, because this was effectively prevented by the dressing. Autodébridement of the third degree areas was not complete at the time of death.

**Case 2.** A 29-year-old woman received second and third degree burns of the right hand, arm, and axilla, estimated to involve about 10 percent of the body surface. A preliminary dressing with vaseline gauze had been applied. Zinax was applied about 90 min. after the injury, and the dressing was removed 15 days later. At this time the second degree areas were healed. There were some areas of third degree burn on the arm and the back of the hand. There was an accumulation of cloudy fluid in the arm area which, however, failed to show any growth on culture. After 4 days of wet dressings, split grafts were applied, and these all healed by primary intention. Although the impression was that these third degree areas were infected, it is quite probable that the secretion observed represented the accumulated lytic material under the dressing and not true infection.

(6) Firor, W. M.: Personal communication.

**Case 3.** A 5-year-old child received first, second, and third degree burns of the right palm, hip, and thigh, involving about 5 percent of the body surface. Zinax was applied 45 min. after the burn and was removed 14 days later. At that time the first and second degree areas were completely healed. On the palm of the hand there was a thick-walled blister which contained some yellow fluid. There was an area of about 14 sq. cm. on the palm of the hand for which grafting was planned, but this was deferred because of mumps and when the mumps was cured this area had filled in from the periphery.

**Case 4.** A 21-year-old man received second and third degree burns of the right lower extremity, involving about 10 percent of the body area. He was admitted to the hospital 9 days after the injury and zinax was applied. The dressings were removed 9 days later. The first and second degree areas were entirely healed. The third degree area was not ready for grafting, but after the application of saline dressings for a few days a split graft was applied. This resulted in 50 percent take and a second grafting was necessary to heal the wound. Zinax was applied late in this case and the results were not quite as satisfactory as those in which it was applied immediately after the burn.

**Case 5.** A 3-year-old child received burns of the neck, shoulder, and face involving 6 percent of the body surface. Zinax was applied 30 min. after the burn. The dressing was removed 2 weeks after the injury and all the first and second degree areas were completely healed. There were 2 small areas of about 2 by 2 cm. which were grafted immediately with a 0.0014-inch split graft. Healing occurred promptly following this treatment.

**Case 6.** A 34-year-old man received second and third degree burns of the entire surface of both forearms and hands, involving about 15 percent of the body surface. He was treated with vaseline gauze and pressure dressings, ACTH, and penicillin for about a month prior to the application of zinax. Zinax dressing was then applied to the area which had not healed and from which the slough had not separated. Ten days after the application of zinax the dressing was removed and the third degree area which had been covered with a purulent crust was clean and there was an area of about 9 by 4 cm. which was clean and ready for grafting. Application of a 0.0012-inch split graft resulted in 95 percent take.

**Case 7.** A 22-year-old man received second and third degree burns of the right leg and ankle. He was admitted to the hospital 4 days after injury. He had had a pressure dressing with vaseline gauze. This dressing was removed and zinax was applied. Fourteen days later the dressings were removed. The first and second degree burned areas were healed and there was a third degree burn of 5 by 2 cm. on the lateral surface of the ankle. At the time the dressing was removed,

this area was clean and a split graft was applied. Healing occurred promptly with minimal scarring.

**Case 8.** An 11-year-old boy received burns of the hands and arms covering about 5 percent of his body surface. Vaseline pressure dressings were applied. These were removed 35 hours later and a zinax dressing was applied. This was removed 11 days later. The first and second degree burns were entirely healed. There were three third degree burns measuring 3 by 3 cm., 2 by 3 cm., and 2 by 2 cm. A few vesicles which had not been ruptured prior to the application of the zinax remained when the dressing was removed. These contained a cloudy fluid, but were not grossly infected. It is probable that the vaseline had been inadequately removed prior to the application of zinax, otherwise this dead skin would have been removed with the dressing. These small areas healed rapidly without grafting.

**Case 9.** A 20-year-old man received burns of the face, both forearms and wrists, and the anterior surface of both legs, covering 20 percent of the body surface. He was treated immediately with vaseline gauze and pressure dressings. Two days later these were removed and zinax applied. This was removed 12 days later. The first and second degree burns were completely healed. There was an area of third degree burn about 2 sq. cm. on the dorsum of the left hand which healed rapidly with nitrofurazone ointment dressings. Grafting was not necessary.

**Case 10.** A 27-year-old woman received first and second degree burns of the face and arm involving about 15 percent of the body surface. She was treated immediately with face cream. Zinax was applied 3 hours after injury and 12 days later it was removed. Epithelialization was complete except for a few moist areas of about 1 by 2 cm. on the face. These were deep second degree burns and were completely healed 9 days later, with minimal scarring.

**Case 11.** A 22-year-old man received a burn involving about 10 percent of the body surface. Vaseline gauze pressure dressings were applied. Twenty-four hours later zinax was applied. This dressing was removed 12 days later. The burns had completely healed, with minimal scarring, except for a third degree burn measuring 5 by 5 mm. on the dorsum of the right hand. This was clean and 3 days later had filled in from the periphery.

**Cases 12 to 22.** The remaining patients received relatively superficial burns involving from 5 to 20 percent of the body surface. Zinax was applied as the primary dressings and removed in from 6 to 14 days, and in all cases all burned areas were completely healed with minimal scarring. No infection was found under the zinax dressing in any of these patients and the material was applied on the day the burn was received in all but one patient who was treated with zinax 2½ days after injury.

## CONCLUSIONS

Although our experience is limited, we believe the following conclusions are justified:

1. This procedure is far superior to any other local treatment for burns.
  2. It is easily and quickly applied.
  3. It can be used in the treatment of large numbers of burns.
  4. Amelioration of pain and distress is marked and rapid after application of the dressing.
  5. The incidence of infection in the burned areas is greatly reduced.
  6. The loss of serum from the burned areas is prevented.
  7. The patient is able to attend to many of his personal needs, thus reducing nursing care.
  8. Transportation of patients treated by this method can be accomplished with minimal difficulty.
  9. First and second degree burns can be healed in from 5 to 12 days.
  10. Areas of third degree burns are self-debrided and ready for split grafts in from 12 to 14 days, which is sooner than has been our experience with any other local treatment.
  11. Healing is accompanied with a minimum of scarring.
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## BOOK REVIEW

The New Military and Naval Dictionary, edited by Frank Gaynor, Editor, "Encyclopedia of Atomic Energy". 295 pages. Philosophical Library, New York, N. Y., publishers, 1951. Price \$6.

This new dictionary is apparently written for nonmilitary personnel. Although it covers a wide range of words and phrases, the definitions are often too brief and noninformative. It will be useful, however, for personnel of any one of the services in interpreting phrases used by the other services. An interesting innovation for a military dictionary is the interpretation of slang expressions used by service personnel during World War II.—*Lt. Col. Carl J. Koehn, MSC, U. S. A.*

# Combined Streptomycin-Tuberculin Therapy in Pulmonary Tuberculosis<sup>(1)</sup>

## A Pilot Study

Eugene C. Jacobs, Colonel, MC, U. S. A.

Joseph R. Vivas, Lieutenant Colonel, MC, U. S. A.

**T**HIS is a report of a method of medical management in pulmonary tuberculosis. It is generally acknowledged that streptomycin, being both tuberculostatic and tuberculocidal (2), exerts a powerful effect on the course of tuberculous infection. It is, however, becoming more and more apparent that certain factors prevent streptomycin from acting directly on the micro-organisms within tubercles.

For many years pathologists and phthisiologists have realized that many forms of tuberculosis, from the tubercle to the chronic far-advanced lesions, are avascular (3-10). It has also been noted that the avascularity of tuberculous lesions interferes with the action of streptomycin (11, 12). Although it has been demonstrated that streptomycin can penetrate both the solid necrotic tubercles and the walls of cavities, the

(1) This work was done at the Walter Reed Army Hospital, Washington, D. C.

(2) Garrod, L. P.: Nature of action of streptomycin on tubercle bacilli. Am. Rev. Tuber., 62: 582-585, Dec. 1950.

(3) Menkin, V., and Menkin, M. F.: Studies on inflammation; measure of permeability of capillaries in inflamed area. J. Exper. Med. 51: 285-293, Feb. 1930.

(4) Menkin, V.: Studies on inflammation; mechanism of fixation by inflammatory reaction. J. Exper. Med. 53: 171-177, Feb. 1931.

(5) Ravina, A.; Sourcee, A.; and Benzaquen, L.: L'angiographie et l'angiopneumographie. Presse Med. 40: 287-291, Feb. 20, 1932.

(6) Birkelo, C. C., and Brusius, W. L.: Roentgen visualization of pulmonary arterial circulation in autopsy material. Radiology 31: 261-292, Sept. 1938.

(7) Lopo de Carvalho; Egas Moniz; and Almeida Lima: L'angiopneumographie et son application dans la tuberculose pulmonaire. Presse Med. 40: 1098-1100, July 13, 1932.

(8) Steinberg, I.; McCoy, H. I.; and Dotter, C. T.: Angiocardiographic findings in pulmonary tuberculosis. Dis. Chest 19: 510-520, May 1951.

(9) Savacool, J. W., and Chart, R.: Thrombosis of pulmonary artery. Am. Rev. Tuber. 1: 42-57, July 1941.

(10) Jacobs, E. C., and Kuhns, D. M.: Avascularity of tuberculous lesions; major problem in therapy. To be published.

(11) Morin, J.: Streptomycin therapy. Acta Tuber. Belg. 40: 48, 1949.

(12) Maurer, G.: Cavernostomy and tamponade of pulmonary cavities with para-aminosalicylic acid. Dis. Chest 16: 676-683, Dec. 1949.

fact that a higher proportion of the bacterial population becomes resistant within these lesions, and resistant to a higher degree than in other lesions, indicates that streptomycin does not penetrate the tubercles in therapeutic concentrations (13). Shamaskin et al. (14) made the following important statement: "Until another and more effective antibiotic against tuberculosis is discovered, we should change our mode of attack on this problem and aim our efforts primarily at finding means of penetrating more effectively the defenses behind which the tubercle bacilli may find protection in the human body. We must enable the drug to make adequate contact with the organism wherever it may be."

### ATTEMPTS TO PENETRATE THE VASCULAR BARRIERS OF TUBERCLES

Various methods of penetrating the vascular barriers of tuberculosis are being tried. Cavemostomy is being used to drain cavities and to introduce the antituberculous agents directly into them (12). Potassium iodide (15-17), antihistaminic agents (18, 19), detergent antibiotics (20), and streptokinase (21) are being used in an attempt to soften or liquify the exudative lesions so that the antibiotic may come into closer contact with the micro-organism. Tuberculin (22-24) is being used in an effort to revascularize tubercles and thus permit greater penetration of the antibiotic.

### RATIONALE OF TUBERCULIN IN THERAPY

Since the original studies of Vuchow (25), it has been generally accepted that tuberculin causes the formation of perifocal inflammatory reactions (increased vascularity) about tuberculous lesions. After

(13) Mediat, E. M., Bernstein, S., and Reeves, F. C.: Demonstration of streptomycin-resistant tubercle bacilli in necropsy specimens. Am. Rev. Tuberc. 63: 449-458, Apr. 1951.

(14) Shamaskin, A., Des Autels, E. J., Sweany, H. C., Morris, L. C.; Zvetina, J. R., and Mindlin, J.: Streptomycin in treatment of miliary and meningeal tuberculosis, based on study of 30 cases. Dis. Chest 16: 763-787, Dec. 1949.

(15) Woody, E., Jr., and Avery, R. C.: Combined effect of potassium iodide and streptomycin on established tuberculosis in guinea pigs. Science 106: 391-392, Nov. 5, 1948.

(16) Woody, E., Jr.; Johnson, H. E., Avery, R. C., and Crowe, R. R.: Combined effect of potassium iodide and streptomycin on far-advanced chronic pulmonary tuberculosis. Dis. Chest 19: 373-386, Apr. 1951.

(17) Rogue, F. T., and Cleve, E. A.: Tuberculus meningitis in children treated with combined streptomycin and potassium iodide. Dis. Chest 19: 319-324, Mar. 1952.

(18) Judd, A. R., and Henderson, A. R.: Use of antihistaminic drugs in human tuberculosis; preliminary report. Ann. Allergy 7: 306-317, 1949.

(19) Millner, T., and Hurst, A.: Tuberculosis and antihistaminics. Dis. Chest 16: 873-878, Dec. 1949.

(20) Grace, E. J., and Bryson, V.: Topical detergent antibiotics in treatment of tuberculous sinuses. Dis. Chest 16: 795-800, Dec. 1949.

(21) Cathie, I. A. B.: Streptomycin-streptokinase treatment of tuberculous meningitis. Lancet 256: 441-442, 1949.

(22) Cavares, C.: Results of treatment of tuberculous meningitis in infants and children with streptomycin. Pédiatrie 37: 549-552, 1949.

(23) Cairns, H., Smith, H. V., and Vollum, R. L.: Tuberculous meningitis. J. A. M. A. 144: 92-96, Sept. 9, 1950.

(24) H. V. Smith, R. L. Vollum, and H. Cairns: The place of tuberculin therapy in per-

Virchow's report tuberculin was regarded by many to be a dangerous form of therapy, mainly because the increased vascularity had permitted a liberation of tubercle bacilli into the blood stream, and in a rare instance, had been followed by a spread of the disease. Recent use of tuberculin desensitization in conjunction with streptomycin indicates that it is a safe procedure. The liberation of tubercle bacilli into the blood stream in the presence of therapeutic levels of streptomycin is a highly desired feature of this form of therapy. The increased vascularity of the tubercles and the increased permeability of the involved vessels permit greater penetration of the antibiotic into the lesions, resulting in tuberculostatic and tuberculocidal actions on the contained organisms.

#### COMBINED STREPTOMYCIN-TUBERCULIN THERAPY

The method of administering the combined streptomycin-tuberculin therapy is described in another article (26).

#### DISCUSSION

Of the accepted treatments for pulmonary tuberculosis, prolonged bed rest has held the foremost place for centuries, primarily because it was the only treatment known which would eventually lead to a cure. In the last decade it has gradually been realized that prolonged bed rest is detrimental to the health of the patient. Unfortunately the phthisiologist has had nothing to substitute for bed rest. Collapse therapy had been successful in curing not more than 15 percent of the patients with pulmonary tuberculosis. This left 85 percent to be treated by bed rest.

Within the last 6 years streptomycin has appeared as the first agent which has proved to be both tuberculostatic and tuberculocidal to the *Mycobacterium tuberculosis*. Although it has brought great hope to the phthisiologist, it has been disappointing because of: (1) its toxicity, (2) its inability to clear many cases, (3) the frequency of relapse, and (4) the emergence of many resistant tubercle bacilli (27). The phthisiologist has not had sufficient confidence in the new antibiotic to substitute it for bed rest, but has preferred to use it as a supplement to bed rest. The toxicity has been largely overcome by giving smaller doses at greater intervals; there has been no noticeable decrease in the efficiency of the streptomycin when 0.5 gram is given twice daily. The inability of the streptomycin to clear many lesions is believed to be due to the avascularity and fibrous encapsulation of the tubercles, resulting in a failure of the antibiotic to penetrate into the lesions in sufficient concentration to produce tuberculostatic and tuberculocidal action against the contained micro-organisms.

(25) Virchow, R.: *Ueber die Wirkung des Koch'schen Mittels auf innere Organe Tuberkulöser*. Berl. klin. Wochschr. 28: 49-54, 1891.

(26) Jacobs, E. C., and Vivas, J. R.: Combined streptomycin-tuberculin therapy in pulmonary tuberculosis: method of treatment. To be published.

(27) Council on Pharmacy and Chemistry, American Medical Association: Streptomycin in treatment of tuberculosis. J. A. M. A. 138: 584-593, Oct. 23, 1948.

By adding tuberculin to streptomycin, the vascularity of the lesions and the permeability of the involved vessels are increased (3,4,25) allowing greater penetration of the antibiotic into them. The frequent relapses of pulmonary tuberculosis within a few months after treatment with streptomycin are thought to be due to the tendency of streptomycin to prevent the formation of fibrous tissue (28) while it is clearing the exudative lesions. Thus little or no protection is left against future reactivation of the lesions.

By adding tuberculin desensitization to the streptomycin therapy, focal reactions are produced about the tubercles. Like other inflammatory reactions, they tend to heal by formation of fibrous and scar tissues which are relatively impermeable barriers against future hydration, hyperemia, and inflammation. The resistance of tubercle bacilli to streptomycin is believed to be due to the low levels of antibiotic within the avascular and encapsulated lesions.

By adding tuberculin desensitization to streptomycin therapy and effecting an increased vascularity of the tuberculous lesions, and an increased permeability of the involved vessels, it is believed that the streptomycin is able to penetrate and diffuse into the lesions in sufficient concentration to result in tuberculostatic and tuberculocidal action rather than the emergence of increased resistance of the microorganisms to the antibiotic.

### RESULTS OF THE COMBINED STREPTOMYCIN-TUBERCULIN THERAPY

Although the combined streptomycin-tuberculin therapy has been used for only 4 years, and this report represents the treatment of a rather small number of patients with pulmonary tuberculosis, it is believed that the results (abeyance of clinical symptoms; roentgenographic improvement; sputum conversion; decrease in sedimentation rate, pulse, and temperature; and increase in appetite, weight, and well-being) have been more rapid than in any similar series treated by streptomycin and other agents. Table 1 presents the results of treatment by this method of the first series of 24 consecutive (unselected) patients with pulmonary tuberculosis. These patients have been observed for from 2 to 4 years. Nineteen remain alive; 8 are apparently cured, 8 are arrested, and 3 have active tuberculosis, but are otherwise in good health.

At present, more than 100 patients with tuberculosis have been treated by more than 200 courses of the combined streptomycin-tuberculin therapy. There have been no untoward results. Toxicity has been of little significance. Clinical improvement, sputum conversion, and roentgenographic clearing, both during and following combined therapy, have been more rapid than in any series treated by streptomycin and

(28) Auerbach, O., and Stembermann, G. N.: Anatomic Change in tuberculosis following streptomycin therapy. Am. Rev. Tuberc. 58: 449-462, Oct. 1948.

TABLE I. Results of treatment

Type of disease	Clinical improvement			Sputum conversion		Streptomycin resistance			Roentgenographic improvement			Total number of cases	
	N	S	Mod	Mkd	Yes	No	Yes	No	N	S	Mod	Mkd	
Acute*													
Minimal	0	1	0	0	1	0	0	1	0	1	0	0	1
Moderate	0	0	3	3	6	0	0	6	0	0	0	6	6
Advanced	1	0	2	1	3	1	0	4	1	0	2	1	4
Subtotal	1	1	5	4	10	1	0	11	1	1	2	7	11
Chronic**													
Minimal	0	2	2	0	4	0	0	4	0	3	1	0	4
Moderate	0	1	3	0	2	2	0	4	0	1	3	0	4
Advanced	0	3	1	1	0	5	2	3	1	3	1	0	5
Subtotal	0	6	6	1	6	7	2	11	1	7	5	0	13
Total	1	7	11	5	16	8	2	22.	2	8	7	7	24

\*One died of bronchogenic carcinoma; his tuberculosis was well controlled by therapy. Another died at Fitzsimons Army Hospital of tuberculosis, diabetes, and arteriosclerosis 1 year following excellent results by combined therapy.

\*\*One died of lobar pneumonia. He was seriously ill on admission and lived in the hospital for 3 months. He was 68 years old. His prognosis appeared hopeless from the time of admission. Another died of advanced tuberculosis. He was seriously ill on admission but lived 24 months in the hospital. He was 80 years old. A third died of myelogenous leukemia. He was 80 years old. A third died of myelogenous leukemia. Her tuberculosis was well controlled on 2 occasions by combined therapy. Terminal spread of her tuberculosis followed the use of ACTH for her leukemia.

N = none, S = slight, Mod = moderate, Mkd = marked



Figure 1. Roentgenogram of chest of a 28-year-old Negro soldier at beginning of therapy (9 June 1948). Figure 2. Same patient on 15 June 1948.

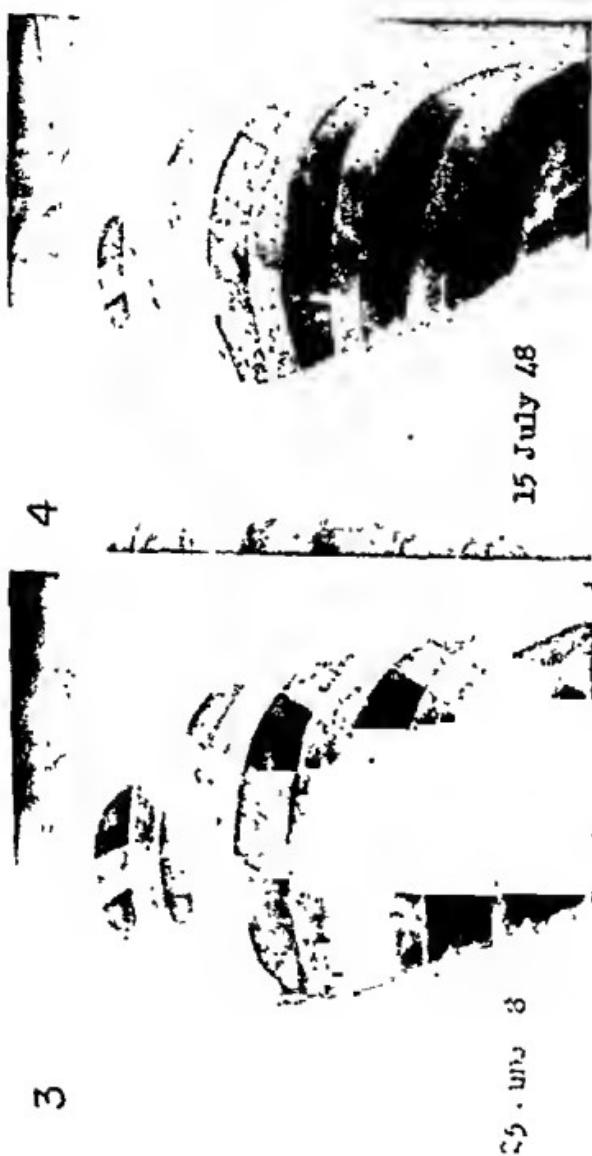


Figure 3. Same patient on 25 June 1948. Figure 4. Same patient on 15 July 1948. Note perifocal inflammatory reaction.

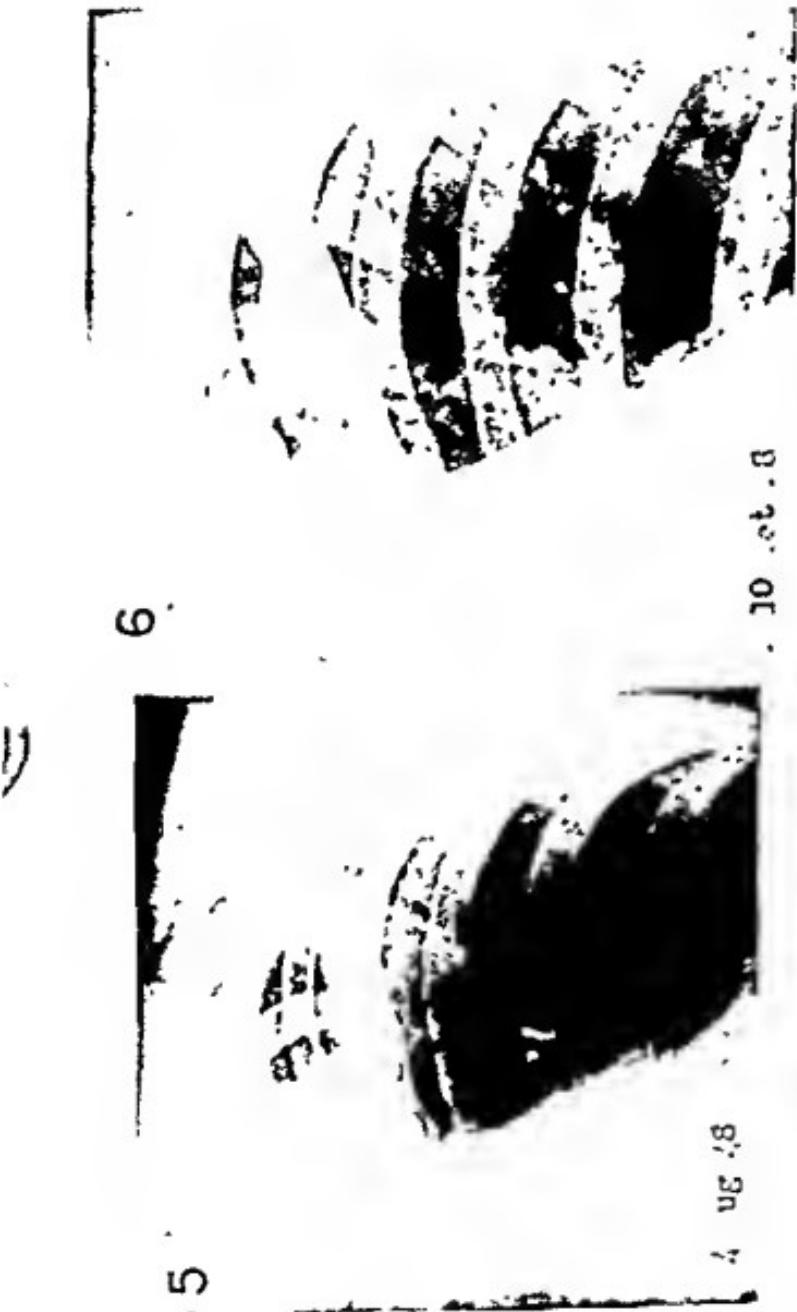


Figure 5. Same patient at termination of combined streptomycin-tuberculin therapy (4 August 1948). Figure 6, same patient 2 months later (10 October 1948). Considered cured at that time.

other agents. Roentgenograms of a patient treated by this method with typical results are shown in figures 1-6. Relapses have been rare after the sputum has been converted consistently for as long as 6 months.

Of the 22 patients in whom the sputum was not converted by combined therapy, the emergence of resistance to 15 micrograms or more of streptomycin has occurred in only 2 (9 percent). This corresponds favorably with the best results obtained by combinations of streptomycin and other antituberculous agents.

### CONCLUSIONS

The clinical, laboratory, and roentgenographic improvement during and following treatment with combined streptomycin-tuberculin therapy have been more rapid than in any similar series treated by streptomycin and other agents. There have been no untoward results. Toxicity has been of little significance. Relapses have been uncommon. Resistance to streptomycin has developed in only 9 percent of the patients in whom the sputum remained unconverted. The relatively short period (2 months) of hospitalization necessary when the combined therapy is used, eases the economic burden on the patient and his family and permits the hospitalization of a greater number of patients.

If the above findings are confirmed by others, it will mean that patients with minimal pulmonary tuberculosis can be treated and cured before they become therapeutic problems, and many patients with chronic far-advanced tuberculosis in whom the prognosis is poor can with repeated courses of treatment gain much clinical improvement.

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### BOOK REVIEWS

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*The Essentials of Modern Surgery*, edited by R. M. Handfield-Jones, M. C., M. S., F. R. C. S., Senior Surgeon to St. Mary's Hospital; Lecturer in Surgery, St. Mary's Hospital Medical School; Member of the Court of Examiners, R. C. S., and Examiner in Surgery to the University of London; Late Hunterian Professor, R. C. S., and Sir Arthur E. Porritt, K. C. M. G., C. B. E., M. A., M. Ch., F. R. C. S., A Surgeon to His Majesty the King; Surgeon, St. Mary's Hospital and Royal Masonic Hospital; Consulting Surgeon, Acton, North Herts and South Beds, Teddington, Hampton Wick and District, and Paddington (L. C. C.) Hospitals; Examiner in Surgery, University of Cambridge. 4th edition. 1263 pages; 644 illustrations. The Williams and Wilkins Co., Baltimore, Md., publishers, 1951. Price \$11.

This single comprehensive volume covers its subject from "Abbott's jacket for Scoliosis" to "Zukerkandl, fascia of." The writing is concise and condensed and the choice of title is fortunate. All surgical specialties are included with almost equal emphasis and the volume could

well have been titled "A One-Volume Encyclopedia of Modern Surgery." The authors have succeeded in compiling a text for general surgery. The presentation is orderly and well classified with a good index and the text should be heartily greeted by the medical student. To some extent the popularity and acceptance of this volume will depend on the rebirth of the general practitioner for whom it should serve as a good source of quick reference to refresh his memory on almost any of the essentials of modern surgery.

A few anachronisms persist such as the advice given in the general treatment of inflammation, "Diet should be reduced to its most nutritive as well as easily assimilable form, e. g., milk, meat juices and extracts, chicken and calves foot jelly, etc." and in the use of a Pier's or Klapp's suction cup to produce local hyperemia. One unusual feature is the 29-page section on venereal diseases with little or no surgical importance in this day of chemotherapy. These, however, are minor shortcomings in the execution of a difficult task and the authors have succeeded admirably in presenting modern surgery in its essence.

—Commander R. M. Mugrage, MC, U. S. N.

**Space Medicine, The Human Factors in Flights Beyond the Earth,** edited by John P. Marburger, Associate Professor of Physiology, College of Medicine, and Director of Research in the Aeromedical and Physical Environment Laboratory, University of Illinois. 82 pages; illustrated. The University of Illinois Press, Urbana, Ill., publisher, 1951. Price \$3.

Stimulated by the establishment of the Department of Space Medicine at the U. S. Air Force School of Aviation Medicine in 1949, a group of serious and distinguished scientists met in Chicago at the Professional Colleges of the University of Illinois on 3 March 1950 to discuss the present aeromedical knowledge adaptable to the problems involved in human flight beyond the stratosphere. This small volume, which is probably the first of its kind, contains 6 articles presented at this symposium which may well serve as the starting point for investigation in this fascinating field of aviation medicine.

In the opening chapter, Major General Harry G. Armstrong, Surgeon General of the Air Force, describes the historical background of space medicine, in which the USAF School of Aviation Medicine has pioneered, and predicts that space flight will someday be reality. Other chapters cover the development of multistage rockets, the physiologic considerations on the possibility of life under extraterrestrial conditions, the relation of astronomy to space medicine, the problem of orientation in space, and, finally, the bioclimatology of manned rocket flight.

This book is easy to read and is recommended to all physicians who desire to have, at least, a nodding acquaintance with the subject. It will be welcomed by all workers in the specialty of aviation medicine.—Col. R. J. Benford, U. S. A. F. (MC)

# Adenocarcinoma of the Appendix<sup>(1)</sup>

Bruce R. McCampbell, *Commander, MC, U. S. N.*

Everett H. Dickinson, *Captain, MC, U. S. N.*

**A**DENOCARCINOMA arising in the appendix is rare. In the military service where appendectomy is a frequent operation the possibility of carcinoma should be kept in mind and when present it should be recognized. Carcinoma of the appendix has been divided pathologically into three types by Uhleio and McDonald (2): (1) carcinoids, (2) carcinomas of the mucous type producing pseudomyxoma peritonei, and (3) carcinomas which resemble both grossly and microscopically the type seen in the colon, the coloic type. It is with a carcinoma of the appendix of this last type that this report deals.

It is difficult to evaluate the reported incidence of primary carcinoma of the appendix of the colonic type because of its rarity and because the incidence rates vary in different series. Harryman (3) reviewed 24,849 surgically removed appendices and found only one tumor of this type; Reitz (4) found 2 adenocarcinomas in 2,520 specimens. One of these tumors might have been more properly classified as the mucous type, because it was described as a tall cell or gelatinous carcinoma. It is apparent that in the series reported by Reitz the incidence is about 20 times greater than in Harryman's series. Uhleio and McDowell (2) classified all of the tumors of the appendix (144) found at the Mayo Clinic from 1910 to 1941 as follows: (1) 127 carcinoids (82.2 percent); (2) 12 cystic carcinomas (8.3 percent); and (3) 5 carcinomas of the coloic type (3.5 percent). Crile and Gleon (5)

(1) From U. S. Naval Hospital, Oakland, Calif.

(2) Uhleio, A., and McDonald, J. R.: Primary carcinoma of appendix resembling carcinoma of the colon. *Surg., Gynec. & Obst.* 76: 711-714. June 1943.

(3) Harryman, J. E.: Mucoid carcinoma of the appendix with pseudomyxoma peritonei, case report. *Harper Hosp. Bull.* 5: 118-126, Aug. 1947.

(4) Reitz, C. B.: Carcinoids, malignant carcinoids, and carcinoma of vermiform appendix. *Hahneman Monthly*, 81: 230-239. June 1946.

(5) Crile, G. Jr., and Gleon, C. G.: Primary adenocarcinoma of appendix with development of mucus fistula. *U. S. Nav. M. Bull.* 47: 328-330, Mar.-Apr. 1947.

reported a case of primary adenocarcinoma of the appendix in a man, 48 years old, who was thought at operation to have an appendiceal abscess. The area was drained and a chronic sinus formed which discharged mucus continuously until another exploratory operation was performed 3 months later when a large papillary carcinoma in the appendix was found. It had not metastasized. Maisel and Foot (6) reported an unusual case in a man with multiple polyposis of the colon in which an adenocarcinoma of the appendix, independent of another carcinoma of the cecum, was found. The case we are reporting here was the only carcinoma of the colonic type found in 1,079 appendixes surgically removed between September 1947 and April 1951 at this hospital.

### CASE REPORT

A 53-year-old man was admitted to this hospital on 5 April 1950 with a diagnosis of myocardial infarction based on electrocardiographic tracings. He gave a history of a sudden onset of severe chest pain 2 days prior to admission. On admission the pulse rate was 104, the blood pressure was 118/85. There was no cardiac enlargement. The heart sounds were distant but were otherwise normal. No masses or areas of tenderness were palpable in the abdomen. The patient had no acute distress.

The white blood cell count was 12,950 with 83 percent segmented neutrophils. The hemoglobin was 12.5. The sedimentation rate was 26. A roentgenogram of the chest taken on 11 April revealed no abnormalities. The ECG showed evidence of a recent posterior infarction of the myocardium. The patient was treated with sedation, bed rest, and dicumarol. His prothrombin time was maintained at about 33 percent of normal with a low of 12 percent on 18 April and 15 percent on 21 April.

On 22 April his eighteenth day in the hospital he complained of a pain in his abdomen. He stated that it began 2 days previously as a generalized pain in the lower abdomen and had become localized in the right lower abdominal quadrant. He also had anorexia and nausea. His temperature was 99.2° F. and his pulse rate was 108. He did not appear to be acutely ill. His abdomen was mildly distended and diffusely tender, the maximum tenderness being at McBurney's point. Rebound tenderness was present at this point. His urine contained 50 mg of albumin per 100 cc. and was loaded with red blood cells. The white blood cell count was 10,600, with 75 percent segmented neutrophils, 3 percent band forms, 20 percent lymphocytes, and 2 percent monocytes. A diagnosis of acute appendicitis was made.

Under ether anesthesia an appendectomy was performed. The appendix was found to be enveloped in a mass of omentum. It was dissected free from the omentum and found to be gangrenous in the

(6) Maisel, B., and Foot, N. C. Multiple polyposis of colon with malignant change involving colon and appendix, case report. Ann. Surg. 126: 262-269, Sept. 1947.

midportion. It was removed and the stump was treated with phenol and alcohol but was not inverted. The patient showed little tendency to bleed in spite of the low prothrombin time. He made an uneventful recovery. The appendix was 3 cm. in length and encased in a mass of omental fat. The distal portion was 1.5 to 2 cm. in diameter and its wall was white and firm. Its lumen was obliterated. (fig. 1).



Figure 1. Cut sections of appendix.

The microscopic section across the base revealed a thickened mucosa and a small lumen. Small lymphoid follicles were present in the submucosa. There was a large amount of fatty tissue beneath the inner circular layer of muscle. The muscle layers were intact but there were several small extravasations of red blood cells in them. The subserosal vessels were dilated, packed with red blood cells, and showed some degree of margination of the polymorphonuclear leukocytes. Sections from the dilated distal portion of the organ displayed a startling hyperplasia of the mucosa. (fig. 2). Papillary outgrowths supported on tenuous connective tissue stalks filled and dilated the lumen. Rounded groups of columnar cells surrounding irregular lumens were seen deep in the wall of the appendix infiltrating the muscular coats and apparently completely detached from the mucosa. There were large collections of a pale-staining, fibrinoid, apparently mucous, material, incarcerated in the submucosa. The cells of the papillary projections and of the deeply situated adenoid structures were crowded together, having darkly-staining, somewhat irregular nuclei, and displaying a large amount of mitotic activity. There was a marked loss of polarity in many instances. The cytoplasm of the cells was abundant and often was filled with large clear vacuoles. The serosa was greatly thickened by a marked overgrowth of fibroblasts intermingled with extravasated red blood cells, polymorphonuclear leukocytes, and fibrin. There were

several points of necrosis in the serosa. One section revealed an irregular group of columnar epithelial cells attached to the serosal surface of the mesoappendix, partially enclosing a mass of pale-staining mucus. The distal portion of the appendix was conspicuously devoid of lymphoid tissue. A diagnosis of primary adenocarcinoma of the appendix associated with acute fibrinopurulent appendicitis was made.



Figure 2. Microscopic section of distal portion of appendix.

The patient was presented to the Tumor Board and it was decided that a right hemicolectomy should be performed. This was done on 25 May. The terminal ileum, cecum, ascending colon, and right half of the transverse colon were resected and an end-to-side ileotransverse colostomy was performed. The pathologist was unable to find any evidence of the neoplasm in the cecum, appendiceal stump, or lymph nodes. The patient made an uneventful recovery and was living and well without evidence of recurrence 1 year after operation.

## DISCUSSION

Anderson (7) stated that adenocarcinoma of the appendix, although rare, is identical in appearance with carcinoma of the colon. The neoplasm is said to involve either the tip or the base of the appendix, usually the latter. In our case the distal end was involved. The neoplasm may be either polypoid or ulcerating and the symptoms may vary accordingly. The polypoid tumors produce obstruction of the lumen and acute appendicitis, and the ulcerating lesions produce melena and anemia. The fact that symptoms of appendicitis are usually recognized by the patient, causing him to seek surgical treatment early, accounts for the excellent results obtained because the tumor is removed before metastasis occurs. When metastasis does occur, which is usually late in the disease, it is to the regional lymph nodes and to the liver. The appendiceal carcinoma in our patient was unsuspected until the pathologist reported its presence. The diagnosis would have been at least suspected in this case had the operating surgeon opened the appendix.

The treatment usually consists of a simple appendectomy because the tumor is not identified until several days later, and it is then found that complete removal of the neoplasm was probably accomplished, and no further operation is considered necessary. If the carcinoma extends into the wall of the cecum, Harryman (3) recommends resection of the cecum using the technic of Jones and Carmody (8). We believe that the treatment of choice is a right hemicolectomy, because this procedure fulfills the criteria of the surgical treatment of cancer in other localities, which is the most radical and yet feasible surgical procedure as soon as the diagnosis of carcinoma is made. The recommended operation removes the neoplasm completely and also any metastatic nodes that may be present. It is the most logical procedure for such a potentially dangerous lesion.

It is desired to make a plea for the surgeon to inspect or have the pathologist examine all the tissue removed at operation. Failure to do this is reprehensible because: (1) it often allows a malignant lesion to be unsuspected and be inadequately treated at the time of the initial operation, (2) the surgeon misses the opportunity to refresh his knowledge of gross pathology at each operation; after the specimen has been placed in a fixative and sent to the pathologist it involves a greater effort for him to go there and examine the specimen; and (3) the tissue may be lost between the operating room and the laboratory. If the surgeon has not examined the specimen, then no one is able to make a diagnosis.

(7) Anderson, W. A. D.: *Pathology*. C. V. Mosby Co., St. Louis, Mo., 1948.

(8) Jones, T. E., and Carmody, M. G.: Mucocele of appendix: report of two cases, one causing intussusception and partial intestinal obstruction. *Am. J. Surg.* 32: 511-515, June 1916.

## BOOK REVIEWS

*British Scientists*, by E. J. Holmyard, M. A., M. Sc., D. Litt., F. R. I. C., Editor of *Endesvor*, Membre Correspondant de l'Academie Internationale d'Histoire des Sciences, Vice-President of the British Society for the History of Science, Chairman of the Society for the Study of Alchemy and Early Chemistry. 88 pages, illustrated with 24 portraits. The Philosophical Library, Inc., New York, N. Y., publishers, 1951. Price \$2.75.

This pocket-size volume contains a brief account of the outstanding accomplishments of noted British scientists including Roger Bacon, William Gilbert, John Napier, William Harvey, Robert Boyle, Isaac Newton, James Hutton, Joseph Black, Joseph Priestley, Henry Cavendish, John Dalton, Humphrey Davy, William Herschel, Michael Faraday, Charles Darwin, Lord Kelvin, James Clerk Maxwell, Lord Lister, William Crookes, William Perkin, James Dewar, William Ramsay, J. J. Thomson, and Lord Rutherford. There are also paragraphs on the Royal Society, the Royal Institution, and the Royal Society of Edinburgh. The book is well written and in portraying these scientists, the author traces the development of modern science. Each sketch is accompanied by a portrait of the scientist.—Col. H. R. Gilmore, Jr., MC, U. S. A.

*The Electrical Activity of the Nervous System, A Textbook for Students*, by Mary A. B. Brazier, B. Sc., Ph. D. (London), Neurophysiologist, Massachusetts General Hospital; Research Associate, Harvard Medical School. 220 pages; illustrated. The Macmillan Company, New York, N. Y., publishers, 1951.

To read the preface of this volume first is a mistake for the allegation of the author that this is a text for students stimulates question as to the need for such a book when such material is presented in any of the better physiology texts. Reading the text corrects this misconception for the author has concisely, succinctly, and even cleverly, by the use of well-chosen words and simple diagrams, presented in logical progression the known information on the electrical activity of nerves. It must be the clarity resulting from leading the reader stepwise through this difficult subject and the occasional arbitrary emphasis of one of many conflicting opinions that has caused the author to think of this as a work for the beginning student. Although the beginner would profit, so would any lecturer in physiology preparing his lecture notes on this subject; so, too, would any researcher in planning or reviewing a program in this field. The knowledge and the gaps in understanding of the electrical activity of the nervous system are clearly pointed out. The major deficiency which arises from the commendable effort to keep the book small is that not all details nor all references could be catalogued so the advanced worker must use additional sources.

—A. H. Lauton, M. D. Ph. D.

# Acne Vulgaris and the Urinary 17-Ketosteroids in Young Men

Claude B. White, Colonel, U. S. A. F. (MC) (1)

Addelia Peterson (2)

Jane C. Neff, B. S. (2)

MEDICAL lore is replete with clinical impressions suggesting an important relationship between the endocrine glands and acne vulgaris. Dermatologists such as Pick, Hollander, Darier, Bloch, Stein, and Schamberg have favored this opinion. In 1783 von Plenck (3) referred to the popular belief that marriage cures pimples. The modern concept of the pathogenesis of acne vulgaris favors an imbalance between the androgenic and estrogenic substances with the emphasis on an androgenic preponderance (4). Although Sulzberger and Witten (5) have written that it is the ratio of circulating androgens to estrogens which is important as related to acne vulgaris, rather than alteration of one or the other component alone, a search of the literature fails to reveal a definitive experimental basis for this theory. A review of the work of several investigators (6-17) demonstrates the need for further work and more knowledge along these lines.

(1) Brooke Army Hospital, Fort Sam Houston, Tex.

(2) Fourth Army Area Laboratory, Fort Sam Houston, Tex.

(3) von Plenck, J.: *Doctrina de Morbis Cutaneis*. 2d edition. R. Graeller, Vienna, 1783. p. 60. Cited by Wittkower, E.: *Acne vulgaris, psychomatic study*. Brit. J. Dermat. 63: 214-223, June 1951.

(4) Sulzberger, M. B., and Baer, R.: *Acne vulgaris and its management*. In Sulzberger, M. B. (editor): *Year Book of Dermatology and Syphilology*. Year Book Publishers, Inc., Chicago, Ill., 1949. pp. 9-39.

(5) Sulzberger, M. B., and Witten, V.: Hormones and acne vulgaris. M. Clin. North America 35: 373-390, Mar. 1951.

(6) Rosenthal, T., and Kurzrok, R.: Excretion of estrin in acne. Proc. Soc. Exper. Biol. & Med. 30: 1150-1151, May 1933.

(7) Rosenthal, T., and Neustaedter, T.: Estrogenic substance in blood of patients with acne. Arch. Dermat. & Syph. 32: 560-562, Oct. 1935.

(8) Wile, U. J.; Snow, J. S., and Bradbury, J. T.: Studies of sex hormones in acne; urinary excretion of androgenic and estrogenic substances. Arch. Dermat. & Syph. 39: 200-210, Feb. 1939.

Because biologic techniques using animals for the assay of androgenic materials are cumbersome, tiresome, and expensive, they have not been widely applied to the problem of acne vulgaris. In the several instances where biologic techniques have been used, too often variance in technics and the use of different measuring units have made comparisons difficult and conclusions questionable. Wile, Snow, and Bradbury (8) employing a biologic assay method for measuring androgen excretion (capon comb growth response), have found that patients of both sexes with acne vulgaris secrete larger amounts of androgen than do normal persons of corresponding age.

It is fairly well established that the measurement of the urinary 17-ketosteroid excretion furnishes a satisfactory index of androgenic activity (18). These urinary 17-ketosteroids are believed to represent the end products of androgenic catabolism. The test has deficiencies but, until better tools are available for the study of such hormones, it will probably continue in use. In the past decade a new colorimetric method for assaying the urinary 17-ketosteroids has been introduced and standardized. Zarrow et al. (19) have found a high degree of correlation to exist between this method and the more laborious biologic assay employing animals and they have concluded that the biologic assay for urinary androgens contributes little information not afforded by the urinary 17-ketosteroid chemical determination. A comprehensive monograph concerning the origin, determination, and significance of the 17-ketosteroids has recently been compiled by Mason and Engstrom (18). Also Escamilla (20) has reported on an extensive clinical

- (9) Corsbleet, T., and Barnes, B. Hormones and acne vulgaris, urinary assay for and therapeutic use of androgen Arch Dermat & Syph 40: 249-252, Aug 1939.
- (10) Sulzberger, M. B., Rosenberg, A., Jr., and Sher, J. J. Acneform eruptions, with remarks on acne vulgaris and its pathogenesis New York State J Med. 34: 899-905, Nov 1, 1934.
- (11) McCarthy, L., and Hunter, O. B. Failure of therapy with glandular preparations in acne vulgaris Arch. Dermat. & Syph. 35: 211-225, Feb. 1937.
- (12) Lawrence, C. H., and Terhessien, N. T. Etiology of acne in females. Internat. Clin. I: 199-205, Mar. 1942.
- (13) Van Studdiford, M. T. Effects of hormones of sex glands on acne Arch. Dermat. & Syph. 31: 333-342, Mar 1934.
- (14) Barber, H. Hormone factors in acne. In Mackenna, R. M. B. (editor) Modern Trends in Dermatology. Paul B. Hoeber, Inc., New York, N. Y., 1948 p 125.
- (15) Way, S., and Andrews, G. Hormones and acne Arch. Dermat. & Syph. 61: 575-593, Apr. 1950.
- (16) Cohen, E. L. Endocrine factors in acne vulgaris Brit. J. Dermat. 53: 231, Aug. Sep., 269, Oct. 1941.
- (17) Goldzieher, M. A. Endocrine pathogenesis and treatment of acne vulgaris. M. Rec 160: 725-727, Dec 1947.
- (18) Mason, H. L., and Engstrom, W. B. The 17-ketosteroids, their origin, determination and significance Physiol. Rev. 30: 321-374, July 1950.
- (19) Zarrow, M. X., Munson, P. L., and Salter, B. T. Comparison of androgens determined biologically and 17-ketosteroids determined chemically in urine (normal and abnormal). J. Clin. Endocrinol. 10: 692-702, July 1950.
- (20) Escamilla, R. Diagnostic significance of urinary hormonal assays Ann. Int. Med. 31: 249-250, Feb 1949.

investigation of the 17-ketosteroids in a miscellany of medical ailments. Still, we are unaware of any reported investigations which apply the urinary 17-ketosternid assay to the study of young men with acne vulgaris.

During 1949 and 1950, we performed urinary 17-ketosteroid assays, using a group of hospitalized patients with acne vulgaris. An endeavor had been made to clarify the probable and casual relationship of androgens to acne vulgaris and also to accumulate background control data for later additional investigations with endocrine therapy. Unfortunately at the time, urinary estrogenic assays were not freely obtainable at our laboratory.

### CLINICAL MATERIAL AND PROCEDURE

Twenty-six young men between the ages of 14 and 30 years comprise this study. Twenty-three of these fell into the age group between 18 and 24 years. All the clinical varieties of acne were represented and all were classified either as severe or moderate in degree. In most, the condition was of over 1 year's duration, had become intractable, and was associated with such military duties as long marches, assignments in the Tropics, or excessive sweating. All patients were hospitalized and generally had been transferred from distant locales because of the severity of their lesions and also because of their unresponsiveness to usual therapy. All patients were placed on a comparable therapeutic regimen and the duration of study averaged about 3 months for each.

Twenty-four hour urine specimens were collected on admission and thereafter at weekly intervals. Records were maintained on the urine volumes. These served as a tough check on the accuracy of collections which were carefully supervised. The technic employed in the 17-ketosteroid determination was that of the standard Army Medical School technic (after Cahen and Salter (21)). Using this method, the normal values for men are between 8.1 to 22.6 mg. (as androsterone) per 24 hours. This agrees closely with the values cited by Mason and Engstrom (18) who give the mean values of 17-ketosteroid excretion for men, obtained by some application of the Zimmerman reaction, as lying between 12.5 and 16.7 mg. per 24 hours, with a lower limit of normal at about 6 mg. and an upper limit at about 25 mg. per 24 hours.

### RESULTS

One hundred and thirty-six separate 17-ketosteroid determinations were performed at weekly intervals. These weekly values for the urinary 17-ketosteroids were averaged, giving particular heed to the age of the patient and the severity of the acne lesions (table 1). The average

(21) Cahen, R. L., and Salter, W. T.: Urinary 17-ketosteroids in metabolism, standardized chemical estimation. *J. Biol. Chem.* 152: 499-509, Mar. 1944.

TABLE I. Urinary 17-ketosteroid excretions in young men with acne vulgaris

Patient	Age (years)	Severity	Duration of observation (days)	Number of tests*	Average urine volume (cc./24 hr.)	17-ketosteroid range (mg./24 hr.)		Average
						Low	High	
1	14	Severe	49	6	1168	9.5	18.2	12.9
2	17	Moderate	70	6	1385	10.6	21.9	15.6
3	18	Severe	231	12	1400	3.7	11.9	7.6
4	18	Moderate	84	11	1704	3.8	12.9	8.4
5	18	Moderate	133	12	1088	4.3	20.3	10.3
6	18	Severe	140	3	1252	8.6	13.7	11.2
7	18	Severe	126	3	1525	11.9	13.8	12.9
8	19	Moderate	77	3	1095	4.8	7.4	5.8
9	19	Moderate	98	2	1185	9.1	10.5	9.8
10	19	Moderate	56	2	870	12.9	14.9	13.9
11	19	Severe	161	11	1513	16.2	20.1	14.0
12	20	Moderate	70	7	1815	10.0	19.3	13.8
13	20	Moderate	14	1	1330	14.3	14.3	14.3
14	20	Severe	91	6	989	10.3	21.4	14.5
15	20	Moderate	42	6	932	9.6	20.1	15.3
16	20	Severe	77	2	1335	15.8	18.3	17.0
17	20	Moderate	161	11	1449	2.7	27.1	17.7
18	20	Severe	91	3	700	17.0	24.8	21.8
19	21	Severe	49	5	1611	5.0	12.9	8.9
20	21	Severe	84	3	1125	8.9	10.7	9.6
21	22	Severe	63	6	1166	12.9	22.9	18.8
22	22	Moderate	119	3	1075	16.6	22.1	19.7
23	23	Moderate	28	3	1660	12.9	15.6	14.3
24	24	Severe	133	2	1950	13.6	23.7	18.6
25	24	Moderate	42	4	2211	18.2	24.0	20.3
26	30	Moderate	35	3	1860	8.6	11.9	10.2
Average	20			69	5.2	1379	10.3	17.5
								13.1

\*Urinalysis for 17-ketosteroids were performed at weekly intervals.

TABLE 2. Weekly variation in 17-ketosteroïd excretion (mg. per day) in 12 patients with acne vulgaris (96 determinations)

Week	Patient											21
	1	2	3	4	5	6	7	8	9	10	11	
1st	18.2	21.9	7.2	8.9	7.7	15.9	16.8	12.2	9.6	20.3	12.9	21.1
2nd	11.9	15.3	2.8	12.9	4.3	15.7	15.5	13.1	18.1	27.1	11.4	19.2
3rd	9.8	10.6	9.5	9.1	14.8	12.4	11.8	10.3	13.6	14.2	8.0	20.1
4th	9.5	13.7	7.1	8.8	10.1	12.9	19.3	11.2	12.8	16.1	7.5	12.9
5th	14.4		7.2	8.7	13.0	12.2	11.4	21.4	17.3	17.1	5.0	16.6
6th	13.4	13.2	7.2	9.3	11.0	10.9	11.8	18.7	20.1	15.1		22.9
7th			11.9	8.3	12.9	20.1						
8th			6.5	7.7	6.9	19.4	10.0					
9th			10.6	8.4	12.2	12.2						
10th		18.9	5.4	7.1	20.3	10.2						
11th			3.7	3.8	11.9	11.2						
Average deviation* (percent)	15	23	29	13	30	22	26	29	22	27	30	17

\* Average deviation from mean calculated according to the method of Kenesberg et al. (22).

for the entire group was found to be 13.1 mg. per 24 hours. This value falls well within the average level for healthy young men in this age group. No correlation was observed between the severity of the acne lesions and the level of the 17-ketosteroids—patient 3 with severe lesions of acne maintained a 17-ketosteroid average of 7.6 mg., no single determination exceeding 11.9 mg. although a total of 12 tests were made. Contrariwise, patient 17 with a moderate degree of acne excreted the highest single quantity of 17-ketosteroid (27.1 mg.). The average for the series of 12 patients classified as having a severe degree of acne was 12.9 mg. whereas the comparable average for the series of 14 patients having lesions classified as moderately severe was 13.6 mg. This slight difference is of no statistical significance.

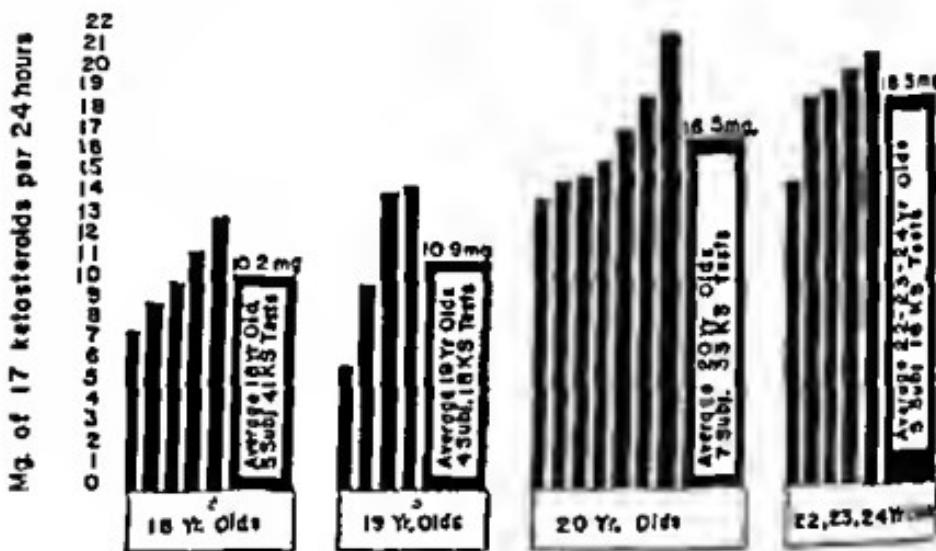


Figure 1. 17-ketosteroid excretion in patients of various ages with acne vulgaris (108 ketosteroid determinations on 21 patients).

The tendency toward an increase in the 17-ketosteroid values associated with an increase in age in years was evident in this study and is depicted in figure 1. These increased values in the patients with acne vulgaris correspond closely to the results observed by Kenigsberg et al. (22) and others (18, 23) in studies performed on normal young men.

The variations from week to week in the 17-ketosteroid output in 12 patients is shown in table 2. Particular attention was given to these variations because conceivably, wide weekly fluctuations in androgenic levels may be of some etiologic significance in acne even though the patient's average level remains within normal limits. This average

(22) Kenigsberg, S., Pearson, S., and McGavack, T. H. Excretion of 17-ketosteroids: normal values in relation to age and sex. *J. Clin. Endocrinol.* 9: 426-429, May 1947.

(23) Nathanson, L. T., Towne, L. E., and Aub, J. C. Normal excretion of sex hormones in childhood. *Endocrinology* 28: 853-865, June 1941.

percentage deviation was found to be 30 percent or less in every case. This falls within the normal range of deviation (18, 24-26).

#### SUMMARY

The 24-hour urinary excretion of the 17-ketosteroids for each of 26 young men with acne vulgaris was determined, using the Army Medical School technic. The total number of 17-ketosteroid tests obtained was 136, each person having a test performed at weekly intervals. The average daily excretion of the 17-ketosteroids for the entire group was found to be 13.1 mg. per 24 hours. In 4 small series arranged according to age (18, 19, 20, and 22 through 24 years) the corresponding values were 10.2, 10.9, 16.5, and 18.5 mg. respectively. The average deviation of the 17-ketosteroid excretion from the mean value for each of 12 patients with acne vulgaris was determined and found to be 30 percent or less (within normal limits).

Through the application of the urinary 17-ketosteroid assay to 26 young men with acne vulgaris, no evidence was obtained to substantiate the concept that acne vulgaris is related to an excess of androgenic hormone. These 26 young men with acne vulgaris excreted quantities of 17-ketosteroids comparable to the quantities excreted by normal young men of similar age.

(24) Kerner, S. C.: Daily variation in 17-ketosteroid excretion of men and women. *J. Clin. Endocrinol.* 1: 931-934, Dec. 1941.

(25) Dreicer, I. J.; Pearson, S., Bartczak, E., and McGavack, T. H.: Rapid method for determination of total urinary 17-ketosteroids. *J. Clin. Endocrinol.* 7: 795-800, Dec. 1947.

(26) Chou, C. Y., and Lu, H.: Cocontents of sex hormones in normal and pathological urine. *Chinese J. Physiol.* 11: 429-435, May 15, 1937. Cited in footnote reference (18).

#### BOOK REVIEWS

Rosenau Preventive Medicine and Hygiene, by Kenneth F. Maxcy, M. D., Dr. P. H., Professor of Epidemiology, The Johns Hopkins University, School of Hygiene and Public Health. 7th edition. 1462 pages; illustrated. Appleton-Century-Crofts, Inc., New York, N. Y., publisher, 1951. Price \$14.

Sixteen years elapsed between the sixth and the new edition of this widely used text. In that time Dr. Rosenau died and the work of revising his book was given into the able hands of Dr. Maxcy. In order to reflect the changes in our knowledge and concepts in preventive medicine which have evolved in the period between the two editions, extensive revision has been necessary. As Dr. Maxcy says in his preface "Increasing attention is being given to the prevention of diseases of noninfectious etiology, to the maintenance of health in middle and old age, and to provisions made by the community for treatment and rehabilitation of the sick and of those who are physically or mentally handi-

and film, varying the time of exposure as follows: (1) frontal, 1 second, open-mouth, 1.5 seconds; maxillary, 1.75 seconds; and lateral, 0.4 second. An extension cone with a diameter of 4 inches is used, with the cone adjacent to the patient's head for the frontal view. The cone is kept at the same distance from the film for the 3 additional views, with a resultant increase in distance between the cone and patient's head on the lateral view. The cone limits the fields so that no other blockage of the film is necessary. An aid in centering the patient is



Figure 3. Routine roentgenogram of paranasal sinuses on a single 14 by 17 inch film.

to draw 2 lines on the table top, as shown in figures 1 and 2. These are drawn at the midportion of each half of the cassette. The R's are placed on the cassette with tape, in such a position as to be included in the fields, before the cassette is inserted in the tray. Routinely the 2 views on the right side of the film are made first, as shown in figures 1 and 2, followed by the 2 on the left. Male patients sit on a

stool, straddling the table; women and children sit on the stool with both knees on one side of the table, rotating the trunk so that the shoulders are parallel to the table surface. A portable upright Bucky diaphragm could be used just as well. Film identification is made in the center of the film by a short exposure of lead markers placed on the cassette, the remainder of the exposed film being blocked with sheet lead, as shown in figure 3.

#### SUMMARY

The advantages of the process described, in which 4 views of the paranasal sinuses are taken on a single 14 by 17 inch film, are that it: (1) reduces film cost, (2) eliminates time required for technician to remove and replace extra cassettes, (3) eliminates time required for darkroom technician to load and unload extra cassettes and film hangers, (4) saves clerk's time in preparing films for reading, (5) saves time in reading the film in that only one film is placed on and removed from the view box, and (6) provides one large-sized film which is easier to find than 4 small films in the conventional large-sized filing envelopes.

#### BOOK REVIEWS

**American Pharmacy, Fundamental Principles and Practices, Pharmaceutical Preparations,** Editor-in-Chief: *Rufus A. Lyman, M. D., Dean Emeritus, College of Pharmacy, University of Arizona.* Advisory Editors: *James M. Dille, Ph. D., Professor of Pharmacology; Noel E. Foss, Ph. D., Dean, School of Pharmacy, University of Maryland; Glenn L. Jenkins, Ph. D., Dean, School of Pharmacy, Purdue University; Rudolph A. Kuever, Ph. D., Dean, College of Pharmacy, State University of Iowa, Hugh C. Muldoon, Dr. Sc., Dean, School of Pharmacy, Duquesne University; and Howard C. Newton, Pharm. D., Dean, Massachusetts College of Pharmacy.* Consulting Editor: *George Urdang, Ph. G., D. Sc. Nat., Sc. D. (H. C.), Director, American Institute of History of Pharmacy, Professor of the History of Pharmacy, University of Wisconsin, and 21 contributors.* 3d edition. 505 pages; illustrated. *J. B. Lippincott Co., Philadelphia, Pa., publishers, 1951.*

This work is designed for use as a textbook in pharmacy. By virtue of their close association with schools of pharmacy the authors are experienced in presenting the material in a manner conducive to assimilation by the student. The book has 2 main divisions. The first deals with fundamental principles and processes, with chapters on metrology; specific gravity and specific volume; heat and refrigeration; purification and clarification; the mechanical subdivision of drugs; solutions; colloids, emulsions, and suspensions; extraction; sterilization; and preservation and packaging. The second is devoted to pharmaceutical preparations and has chapters discussing waters; syrups and juices;

solutions, injections, and ampuls, infusions and decoctions; mucilages, creams, glycerogelatins, glycerites, and collodions; mixtures, magnas, and gels, soap and oleates; liniments, lotions, petroxolins, and sprays; ointments, cerates, plasters, and cataplasms; emulsions, suppositories, spirits and elixirs; vinegars, tinctures, fluid glycetates, and extracts, resins and oleoresins; masses, pills, troches, and tablets, powders, capsules, cachets, oil sugars, candy medication, and triturations; and effervescent salts. The physical make-up of the text is excellent for purposes of study. The paper is good, the print is clear, and the arrangement on the page makes reading easy and minimizes eye fatigue. The range of material is adequate, the arrangement is logical, and the information is well selected and well presented. The illustrations are especially good. The earlier editions have been in use in the Pharmacy Technicians School of the U. S. Naval Medical School, National Naval Medical Center, for several years and have been found very satisfactory. The new edition is a worthy successor.

—Commander R. L. Taylor, MSC, U. S. N.

*The Psychology of Flight*, by Alex Varney. 269 pages. D. Van Nostrand Co., Inc., New York, N. Y., publisher, 1950. Price \$3.75

Written not by a psychologist, but by a veteran flight instructor, this volume explains in plain understandable language the emotional and physical factors which confront the student pilot during his training period. The author's broad experience enables him to illustrate the many situations he describes by anecdotes or parables which, though generally acceptable, in some cases seem to oversimplify the subject under discussion. The topics covered in the various chapters indicate that consultation with qualified psychologists was obtained, and this is acknowledged in the preface. Flight surgeons and other physicians associated with aviator training can safely recommend this book to flight instructors and advanced students. It does not seem entirely suitable for primary students.—Col. R. J. Benford, U. S. A. F. (MC)

*The Structure of the Fowl*, by O. Charnock Bradley, M. D., D. Sc., F. R. C. V. S. Revised by Tom Grahame, T. D., F. R. C. V. S., F. R. S. E., Professor of Anatomy, Royal (Dick) Veterinary College, Edinburgh, Lecturer on Comparative Anatomy, University of Edinburgh. 3d edition. 128 pages, illustrated. J. B. Lippincott Co., Philadelphia, Pa., publisher, 1951.

This new edition of a well-known text is an excellent reference book that deals not only with the gross structure of the avian body but also with the histology of its tissues and organs. The book is well written, concise yet complete, and copiously illustrated. The book is divided into 13 chapters, each of which deals with a single anatomic system or set of organs. A large section deals with the embryology of the chick.

—Lt. Col. K. H. Willers, VC, U. S. A.

# Chylous Ascites of Unknown Cause<sup>(1)</sup>

Leo W. Olechowski, *Commander, MC, U. S. N.*

John H. Froyd, *Lieutenant, junior grade, MC, U. S. N. R.*

**T**HE presence of chylous fluid within the body cavities constitutes an extremely rare entity, more especially so in the absence of trauma as a cause. Jahsman (2) was able to find reports of only 105 patients with chylous ascites of which about 40 percent were non-traumatic in origin. Yater (3) estimated the total number of reported cases of nontraumatic chylothorax at less than 100. The following case demonstrates the finding of a chylous fluid within the abdominal cavity without an obvious cause.

## CASE REPORT

A 22-year-old seaman entered this hospital with a history of lower abdominal pain of gradual onset which was cramping in nature at first, gradually became steady, and then localized in the right lower quadrant. The symptoms began 2 days before hospital admission. Nausea without vomiting was present from the onset of the symptoms. The patient denied respiratory or genitourinary symptoms. The stools had been normal in appearance and frequency. Trauma was denied.

Physical examination revealed a temperature of 99° F., pulse 92, respirations 18, and a blood pressure of 118/76. The patient appeared to be in moderate distress. There was slight muscle guarding of the lower abdomen, three plus tenderness in the right lower abdominal quadrant, two plus tenderness in the left lower abdominal quadrant and rebound tenderness in both lower quadrants. No scars were noted and no organs or masses were palpable. Peristalsis was normal. Rectal examination revealed minimal tenderness which was located high on the right side. The leukocyte count was 13,200 with 2 neutrophilic band cells, 91 neutrophils, 4 lymphocytes, and 3 monocytes per 100 cells.

(1) U. S. Naval Hospital, Oakland, Calif.

(2) Jahsman, W. E.: Chylothorax; brief review of literature; report of 3 non-traumatic cases. *Ann. Int. Med.* 21: 669-678, Oct. 1944.

(3) Yater, W. M.: Non-traumatic chylothorax and chylopericardium; review and report of case due to carcinomatous thromboangiitis obliterans of the thoracic duct and upper great veins. *Ann. Int. Med.* 9: 600-616, Nov. 1935.

A tentative diagnosis of acute appendicitis was made and an exploratory laparotomy was performed. On opening the abdomen, about 900 cc. of opalescent milky fluid was found to be free within the peritoneal cavity. The appendix was found to be chronically inflamed and was removed in the usual manner. The terminal ileum was explored for a distance of 3 feet and found to be normal. A cigarette drain was inserted into the pelvis, the incision was closed, and an 8-inch right paramedian incision was made. The liver, diaphragm, gallbladder, and spleen were found to be normal. The anterior part of the stomach was infiltrated subperitoneally by a chylous substance which also invaded the stomach wall. The lesser peritoneal cavity was opened. The posterior part of the stomach was normal except for an area of dimpling which appeared to be the scar of a healed ulcer which had previously perforated. The pancreas was normal. On the right side the chylous fluid was not only under the viscerai and parietal peritoneum, but invaded the walls of the colon giving it a milky appearance. Oozing of this substance was noted through all layers of the peritoneum. The left side of the peritoneal cavity was relatively normal and examination of the mesentery revealed only the presence of chylous fluid between the mesenteric folds of some areas. A second cigarette drain was inserted through a right flank stab wound; 600,000 units of penicillin and 1 gram of streptomycin were instilled into the abdominal cavity. The wound was then closed.

The patient's course was uneventful. Slight drainage of chylous sanguineous material was seen issuing from the drains for the first 24 hours. The drainage thereafter rapidly decreased and finally subsided. The wounds healed and the patient's temperature was normal. The patient was ambulatory by the eighth postoperative day.

Examination of the chylous fluid revealed the following: Total cholesterol, 123 mg. per 100 cc.; amylase, 34 mg. per 100 cc., lipid phosphorus, 2.71 mg. per 100 cc.; and several fat globules per drop of fluid were found by staining with Sudan III. The patient's blood non-protein nitrogen on the same day was reported as 34.3 mg. per 100 cc., with a total protein of 6.8 grams per 100 cc. of which 5.3 grams were albumin and 1.5 grams globulin. The blood total chlorides were 580 mg. per 100 cc. A leukocyte count on the first postoperative day was 18,850 with 11 band forms, 67 neutrophils, and 22 lymphocytes per 100 cells. A red blood cell count on the same day was 5,030,000 and a hemoglobin determination was 14.5 grams per 100 cc. A roentgenogram of the chest was reported as showing no significant abnormality of the heart, lung fields, or other structures.

A follow-up laboratory examination on the thirteenth postoperative day revealed a total serum protein of 7.3 grams per 100 cc., of which 5.1 grams were albumin and 2.2 grams globulin. A culture of the chylous fluid was reported to have an abundant growth of anaerobic gram-positive staphylococci. The blood Kahn test was negative. The excised

appendix was reported to show fibrous obliteration of the submucosa, mucosa, and lumen and a submucosal neuroma was present. The patient was discharged on the twenty-fifth postoperative day.

### DISCUSSION

The detection of true chyle in the peritoneal cavity is often difficult and although it is admittedly open to some question in the case reported, the low cholesterol and lipid phosphorus is definitely consistent with such a finding (4). Furthermore, the presence of large numbers of fat globules in an opalescent, odorless, milky fluid is believed to establish that the fluid is chyle (5, 6). The origin of the chylous material in this case can only be guessed. The largest single cause of chylothorax and chyloperitoneum is traumatic rupture of the thoracic duct (5). MacNab and Scarlett (7) classify the causes of trauma to the duct as follows:

1. External violence (closed trauma; trauma with fractured ribs, clavicles, or vertebrae; gunshot wounds; and stab wounds).
2. Operative wounds with complete duct severance or section of one or more terminals.

The most common cause of nontraumatic chylothorax is malignancy, either by obstruction of the thoracic duct or by multiple metastases to the lymphatic system (3, 6, 8). It is difficult, however, to reconcile the concept of obstruction as the cause of chylothorax and chylous ascites with that of Lee (9) who, after ligation of the thoracic duct in mice, demonstrated that this duct was not essential for life in these animals and that neither type of chylous effusion occurred. Ehrenhaft and Meyers (10) reported a case of inadvertent ligation of the supradiaphragmatic portion of the thoracic duct, and noted that ligation was better tolerated than section of the duct. The possibility of producing chylous ascites by lymph node compression of the lesser and collateral lymph channels and the main thoracic duct has not been excluded by Lee's experiments. Chylous ascites is also listed by Christopher (8)

(4) Everett, M. R.: *Medical Biochemistry*. 2nd edition. Paul B. Hoeber, Inc., New York, N. Y., 1946. pp. 214-216.

(5) Griffith, R. L.: Chylous ascites and chylothorax. *Northwest Med.* 47: 800-803, Nov. 1948.

(6) Pratt, J. H. (Rochester, Minn.), and McCready, F. J.: Multiple polyps, multiple intussusceptions and chylous ascites; report of unusual case. *S. Clin. North America* 29: 1209-1213, Aug. 1949.

(7) MacNab, D. S., and Scarlett, E. P.: Traumatic chylothorax due to intrathoracic rupture of thoracic duct. *Canad. M. A. J.* 27: 29-36, July 1932. Quoted by Baertsfeld, E. H.: Traumatic chylothorax from ruptured thoracic duct treated by intravenous injection of asparted chyle. *J. A. M. A.* 109: 16-18, July 3, 1937.

(8) Christopher, F. (editor): *A Textbook of Surgery*. 3d edition. W. B. Saunders Co., Philadelphia, Pa., 1944. pp. 237-238.

(9) Lee, F. C.: Establishment of collateral circulation following ligation of the thoracic duct. *Bull. Johns Hopkins Hosp.* 33: 21-31, Jan. 1922.

(10) Ehrenhaft, J. L., and Meyers, R.: Blood fat levels following supradiaphragmatic ligation of thoracic duct. *Ann. Surg.* 128: 38-45, July 1948.

and Thorek (11) as a frequent accompaniment of congenital or secondary lymphangiectasis. Both authors noted that the development of ascites is slow.

Rupture of a cavernous lymphangioma or cyst of the mesentery has been mentioned by some as a cause of chylous fluid within the abdominal cavity (8, 12, 13). The absence of roentgenologic evidence of intrathoracic fluid supports this opinion in explanation of our case. Chylous ascites is generally found in conjunction with chylothorax, except when the cause is limited to the abdomen (6). Yater (3) stated that chylous ascites was present in one-half of the cases of chylothorax reviewed by him.

According to Moore (14), the commonest cyst of the mesentery is a lymphatic cyst resulting from an anomalous development or obstruction of the lymphatic vessels. Cysts derived from the Wolffian duct and from partial duplication of the intestine and true dermoid or teratomatous cysts are less frequently seen. Peterson (15) included chylous (as well as serous, sanguineous, and dermoid) cysts in his classification of cysts arising from embryonic remnants and sequestered tissue. He did not mention lymphatic obstruction. In Benedict's report of 96 cases of mesenteric cyst, no definite age incidence was found, with the sex distribution being equal (16). Garfield (12) reported a maximum incidence in the fourth decade of life, with women developing the lesion twice as often as men. Thorek (17) stated that mesenteric cysts usually have as their only symptom a slowly enlarging painless abdomen, but that severe abdominal pain with vomiting may occur. Garfield (12) and Beahrs and Judd (13) indicated that rupture of a mesenteric cyst may simulate an acute abdominal condition. The most common condition produced is an acute mechanical obstruction caused by volvulus, angulation of the bowel, adhesions, intussusception, stenosis of the bowel, or pressure (13). Friend (18) reported 52 true chylous cysts without any mention of rupture. Alesen (19) reported a cyst in a 5-year-old boy which simulated acute appendicitis. The cyst was unruptured. The amount of fluid seen in our patient is not unusual in unruptured

(11) Thorek, H.: Modern Surgical Technic. 2nd edition. J. B. Lippincott Co., Philadelphia, Pa., 1949. p. 929.

(12) Garfield, J. O., Jr.: Study of mesenteric cysts, with report of 2 recent cases. Ann. Surg. 94: 329-332, Sept. 1932.

(13) Beahrs, O. H., and Judd, E. S., Jr.: Chylangiomas of the abdomen, report of case. Proc. Staff Meet., Mayo Clin. 22: 277-304, July 23, 1947.

(14) Moore, R. A.: A Textbook of Pathology. W. B. Saunders Co., Philadelphia, Pa., 1944. p. 852.

(15) Peterson, E. T.: Cysts of mesentery. Ann. Surg. 112: 80-86, July 1940.

(16) Benedict, A. L.: Bibliography of chylous cysts of mesentery. Surg., Gynec. & Obst. 60: 610, June 1913.

(17) See reference footnote (11), pp. 2073-2074.

(18) Friend, E.: Mesenteric chyle cysts. Surg., Gynec. & Obst. 15: 1-6, July 1912.

(19) Alesen, L. A.: Mesenteric chylous cysts, report of case. California & West. Med. 30: 261-262, Apr. 1929.

cysts. Wilson (20) reported a cyst containing more than 2,000 cc. of fluid in an 8-year-old child and Lamb (21) described one containing 1,000 cc. of fluid which caused an intestinal obstruction by pressure in a 5-year-old child.

The absence of evidence of chylothorax in our patient, the lack of other pathologic findings within the abdominal cavity, and the uneventful convalescence suggest the possibility of leakage from, or rupture of, a mesenteric cyst. The subsequent collapse of the walls may have presented an appearance resembling the mesentery proper. The presence of the chylous fluid beneath the peritoneum also supports this idea.

The prognosis of chylous ascites resulting from trauma or section of the thoracic duct is uncertain. Jahsman (2) reported a 50 percent mortality in patients with chylothorax from the continued loss of fluid rich in protein (up to 4 percent (20, 22)) which leads to rapid dehydration and malnutrition. The prognosis in chylous ascites secondary to other lesions is that of the underlying disease modified by the ascites. The prognosis of mesenteric cysts likewise is extremely variable, depending largely on the size and location of the cyst, the type of disturbance created by its presence, and the technical nature of the surgical procedures necessary to effect relief.

The treatment of a ruptured cyst is not discussed in the literature reviewed, although the procedures of removal recommended are dissection with or without segmental resection and/or enterostomy or marsupialization (12, 16). The therapy of chylous ascites secondary to carcinoma is basically that of the underlying disease. Surgical attempts to locate and repair a tear of the duct in traumatic chylothorax and chylous ascites are usually unsuccessful (5). Griffith (5) advised supportive measures with a high protein diet and fluid replacement therapy. Bauersfeld (22) and Jahsman (2) reported rather dramatic success by intravenous replacement of fluid obtained by thoracentesis. Whitcomb and Scoville (23) reported a case of anaphylaxis with this procedure. Heppner (24) indicated oral feeding of the chyle obtained by paracentesis may be of aid.

(20) Wilson, G. I.: Chylous mesenteric cyst. *Brit. M. J.* 1: 102-103, Jan. 19, 1929.

(21) Lamb, E. J.: Mesenteric chylous cyst, report of case. *California & West. Med.* 31: 139, Aug. 1929.

(22) Bauersfeld, E. H.: Traumatic chylothorax from ruptured thoracic duct treated by intravenous injection of aspirated chyle. *J. A. M. A.* 109: 16-18, July 3, 1937.

(23) Whitcomb, B. B., and Scoville, V. B.: Methods of marking plane of section in open lobotomy operation. *Radiology* 54: 741-742, May 1950.

(24) Heppner, G. J.: Bilateral chylothorax and chyloperitoneum. *J. A. M. A.* 102: 1294, Apr. 21, 1934.

## SUMMARY

A case which showed free and subperitoneal fluid consistent with chyle and which simulated an acute abdominal emergency is presented. The chylous peritoneal effusion was without obvious cause. A chylous mesenteric cyst may have produced the findings.

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## BOOK REVIEWS

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*Syphilis*, by Richard S. Weiss, M. D., Professor Emeritus of Clinical Dermatology, School of Medicine, Washington University, Dermatologist-in-Chief, The Bernard Free Skin and Cancer Hospital, St. Louis; and Herbert L. Joseph, M. D., Consultant in Dermatology and Syphilology, U. S. Air Force Base, Travis Air Force Base, Calif., Instructor, Department of Medicine, Division of Dermatology, Stanford University School of Medicine, San Francisco. 180 pages, illustrated. Thomas Nelson & Sons, New York, N. Y. publishers, 1951. Price \$5.

The object of this book is to provide a brief but comprehensive text for the general practitioner, the medical officer, and the student. In order to be useful to the medical officer it should provide a concise source of authoritative information on diagnosis, treatment, and post-treatment evaluation. We are, however, offered no criteria for the diagnosis of latent syphilis, no single integrated regimen of therapy for syphilis in its various phases, no schedule of follow-up examinations, and no criteria for determining relapse or clinical cure. The clinical discussions are clearly written and the photographs are excellent. Grammatical errors and contradictions are noted throughout the text. This book cannot be recommended as a guide for the medical officer.

—Lt. (jg) J. F. Morrill, MC, U. S. N.

*Roentgen Anatomy*, by David Steel, M. D., St. John's Hospital and Evangelical Deaconess Hospital, Cleveland, Ohio. 54 plates. Charles C Thomas, Publisher, Springfield, Ill., 1951.

This volume is a good reference in roentgen anatomy. The diagrams accompanying the roentgenograms are adequately labeled and include all structures of the bony skeleton. To make this work complete, a normal bronchogram, pneumoencephalogram, pyelogram, cardiogram, cerebral angiogram, and gastrointestinal series should be added. In its present form, however, it should prove of value to students and the average roentgenologist.—Commander M. W. Mason, MC, U. S. N.

# Salicylate Intoxication in Children<sup>(1)</sup>

Arthur C. Dietrick, Captain, MC, U. S. A.

Harold L. Guard, Major, MC, U. S. A.

Leo J. Geppert, Lieutenant Colonel, MC, U. S. A.

**P**HYSICIANS who seldom treat infants are usually careful when using major drugs but are apt not to use due caution when prescribing medication such as aspirin which they consider innocuous. The death of a child from an overdose of aspirin stimulated the preparation of this report. Although salicylate idiosyncrasy does occur (2) salicylate poisoning in pediatric practice is usually caused by improper dosage in the infant less than 1 year of age and by accidental ingestion in the "toddling" age group.

Six cases of salicylism were diagnosed on the pediatric service of this hospital between March 1947 and February 1951. The ages ranged from 3 months to 3 years. Three cases were caused therapeutically by medication prescribed by physicians for infants between 3 and 6 months of age. The other three patients, aged 2 to 3 years, accidentally ingested salicylates. During the period from 1933 to 1943, about 52 fatal cases of salicylism were reported to the United States Census Bureau each year. Slightly over half of these patients were less than 4 years of age. Only a fraction of the cases are reported because this diagnosis is easily missed by both clinician and pathologist. The following cases illustrate the problems encountered.

## CASE REPORTS

**Case 1.** On 26 February 1947 a 3-month-old boy developed a "cold" characterized by nasal discharge, cough, fever, and anorexia. Four days later about 0.3 gm. of aspirin every 4 hours, was prescribed by a physician. The baby was hospitalized the following day at an adjacent station hospital. Physical examination at that time revealed a temperature of 105° F., restlessness, rapid labored respirations, and abdominal distention. His condition became worse with cyanosis and brachypnea, and he was transferred to this hospital on 4 March.

(1) Brooke Army Hospital, Fort Sam Houston, Tex.

(2) Gross, M., and Greenberg, L. A.: Salicylates. Hillhouse Press, New Haven, Conn., 1948, p. 128.

Physical examination revealed a well-developed, moderately dehydrated infant who appeared seriously ill. He weighed 5 kg. Lateral nystagmus was noted. His gag reflex was absent and excess mucus was present in the oral pharynx. His left tympanic membrane was slightly hyperemic. There was mild inspiratory substernal retraction. The respiratory rate was 44. Moist rales were heard over the right upper anterior portion of the chest. The abdomen was moderately distended and tympanitic. Peristaltic sounds were not heard.

Immediate treatment consisted of oxygen inhalations; sixth molar sodium lactate solution, and 2.5 percent dextrose in saline solution parenterally; penicillin; and gastric lavage. The material obtained by lavage was dark red and black. About 12 hours after admission his condition was critical. He was comatose and there were generalized convulsive twitchings. His temperature was 104° F. and his skin was ashen. His neck was flaccid and the anterior fontanel was depressed.

His leukocyte count was 13,000 with 65 percent polymorphonuclear cells and 28 percent lymphocytes; hemoglobin was 70 percent; clotting time was 1½ minutes; prothrombin time was 55 seconds; carbon dioxide combining power was 39 volumes per 100 cc.; blood urea nitrogen was 29 mg. per 100 cc. A "bloody" spinal tap revealed 10 leukocytes (6 polymorphonuclear cells and 4 lymphocytes); 44.8 mg. of sugar per 100 cc.; and 64.3 mg. of protein per 100 cc. The blood salicylate level was 42 mg. per 100 cc. A roentgenogram of the chest was normal.

Further therapy consisted of continuous parenteral fluids, blood transfusions, parenteral vitamin K (a total of 25 mg.), and 100 mg. of ascorbic acid daily. The fever was controlled with the application of cool moist towels and the convulsions by phenobarbital sodium. The patient became afebrile and responsive on the following day, crying and taking glucose and water by mouth. There were no further convulsions. At this time the carbon dioxide combining power was 45 volumes per 100 cc.; the prothrombin time was 7 seconds; and the blood urea nitrogen was 16 mg. per 100 cc. The urine was negative for salicylates on the fourth hospital day. Stools obtained by daily enemas were tarry until 8 March. The abdominal distention subsided gradually with the use of enemas, rectal tubes, and prostigmine parenterally. He was discharged cured on the seventh hospital day.

**Case 2.** A 5-month-old boy developed an upper respiratory infection on 5 August 1948. On 9 August he was seen by a civilian physician who diagnosed tonsillitis and prescribed penicillin nose drops, 4 cc. of liquid sulfadiazine every 4 hours, and powders, each containing 0.2 gram of codeine and 2.36 grams of empitin compound (1.22 gm. of aspirin). This error in dosage came about because the physician did not write his prescription plainly and the pharmacist made up 12 papers each containing the total amount intended for 12 doses. The parent was instructed to give 1 powder p. r. n. for fever. At noon on 11 August the infant was given 4 cc. of liquid sulfadiazine and

1 powder. By 1300 hours he was drowsy and although could not be awakened, the parent gave him these medicines every 4 hours for 4 more doses. He was admitted to this hospital on 12 August because of extreme drowsiness.

On physical examination the patient was stuporous and the pupils were pinpoint with only slight reaction to light. His respirations were deep; the rate was 28. His temperature was 101° F. He weighed 6 kg.

Lumbar puncture and a roentgenogram of the chest were negative. The leukocyte count was 15,000 with 51 percent polymorphonuclear cells and 41 lymphocytes. The urine was positive for salicylates through the second hospital day. Fluids were forced orally with no emesis. Penicillin was administered parenterally. The patient was afebrile on the third hospital day and made an uneventful recovery.

**Case 3.** A 5-month-old girl developed fever and cough on 8 July 1948. She was examined by a pediatrician who made no specific diagnosis but advised penicillin every 3 hours. Further medication consisted of 4 cc. of elixir of benadryl q. i. d., given for an undetermined time during and preceding the illness. On the night of 13 July and the morning of 14 July, the baby refused food and fluids, and vomited those administered; in addition, she began to have rapid deep respirations.

She was admitted to this hospital that same morning, where she was found to be semicomatose, moderately dehydrated, and acidotic. Her temperature was 101.5° F.; her respiratory rate was 45; and her pulse was 86. She weighed 6.5 kg. She had a heavy, frothy, purulent nasal discharge and postnasal drip. Her respirations were of the Kussmaul type; her breath sounds were roughened with occasional moist rales at both apices; her heart tones were rapid and faint; and her abdomen was distended. Opisthotonus was evident. The impression on admission was dehydration and acidosis and probable developing laryngotracheobronchitis.

A lumbar puncture was negative. Her carbon dioxide combining power was 36 volumes per 100 cc. Seventy-five cubic centimeters of sixth molar sodium lactate solution were given subcutaneously. One and one-half hours after admission her respirations became obstructive in type with dyspnea and retraction of the interspaces, and the thick, frothy, purulent secretion became abundant in the nose and mouth. An emergency roentgenogram of the chest was negative. Her leukocyte count was 15,700 with 40 percent neutrophils and 60 percent lymphocytes. She was given 20,000 units of diphtheria antitoxin intramuscularly; oxygen inhalations; 60 mg. of aminophylline every 4 hours; 15,000 units of penicillin every 3 hours; 4 cc. of a 5 percent solution of sodium sulfadiazine every 6 hours; 0.75 cc. of coramine; and 350 cc. of sixth molar sodium lactate solution.

On the second hospital day following the giving of fluids intravenously the thick secretions subsided; respirations became shallow

The leukocyte count was 16,850, with 80 neutrophils and 19 lymphocytes. The hemoglobin was 12.5 grams. The urine was positive for sugar and acetone. The prothrombin time was 25 seconds (control 17 seconds). Twelve hours after admission the patient was afebrile and the oral intake was adequate. On the second hospital day the carbon dioxide combining power was 44 volumes per 100 cc.; the urinary salicylates were 29.7 mg. per 100 cc.; the blood salicylates were 17.8 mg. per 100 cc.; and the blood pH was 7.54. The spinal fluid was normal and negative for salicylates. Parenteral fluids were discontinued after 24 hours and the patient was alert with normal sensorium. On the third hospital day the blood and urine were negative for salicylates. The blood pH was 7.55. The urine was negative for acetone and diacetic acid. On the fifth hospital day the carbon dioxide combining power was 44 volumes per 100 cc.; the blood sugar was 82 mg. per 100 cc.; the blood urea nitrogen was 15 mg. per 100 cc.; and the blood was negative for salicylates. On that day the child was discharged from the hospital.

### DISCUSSION

A history of salicylate ingestion is the best clue for the diagnosis of salicylate intoxication. Unfortunately this information is often not obtained. Accidental ingestion, unless observed directly by an adult, may not be suspected. Salicylates are given so freely by parents, and even physicians, that unless questions are direct, no mention of its use may be made. In the fatal case reported here a history of aspirin administration was not obtained until after the diagnosis had been made. Hyperventilation in an infant or child who is not seriously dehydrated, and whose history reveals none of the usual causes of acidosis, suggests salicylate intoxication (3). In any obscure illness salicylate poisoning should be considered.

The principal presenting symptoms may include mild dehydration, vomiting, stupor with periods of irritability, generalized convulsions or twitching, cyanosis, abnormal respiration as to rate or depth, acetone odor of the breath, abdominal pain, fever, thirst, polyuria, a hemorrhagic tendency, and, in older children, tinnitus. The cases described here are summarized in table 1, which shows the variability of the presenting complaints, and that no "typical" syndrome can be anticipated in salicylate poisoning. The only symptom common to all of our cases was abnormal respiration.

The diagnosis of salicilism must therefore usually be made by laboratory examination, both direct and indirect. Direct examination of the blood and urine for salicylates proves that the drug has been ingested. This may be made simply when laboratory facilities are not available by using the ferric chloride or ferric nitrate tests for the

(3) Barnett, H. L.; Powers, J. R., Bewar, J. H., and Hartmann, A. F. Salicylate intoxication in infants and children. *J. Pediat.* 21: 214-223, Aug. 1942.

qualitative demonstration of salicylate in urine, spinal fluid, or blood serum. Blood salicylate levels of less than 40 mg. per 100 cc. which are well tolerated by adults or older children may produce acute intoxication in infants. Experimental work on the absorption of salicylates tabulated by Gross and Greenberg (4) indicate its appearance in the blood about 10 minutes after ingestion and in the urine in about 20 minutes. The average time required to reach the maximum blood level is about 1 hour after oral ingestion, but with variations up to 12 hours reported by different investigators. Urine and blood are negative for salicylate about 48 hours following a single oral dose. Dubow and Solomon (5) found that a dose of 0.1 gram per kg. of body weight resulted in a blood level of from 19 to 21 grams per 100 cc. and the blood level was approximately doubled with a dosage of 0.125 grams per kg.

TABLE I. Symptoms and signs on admission

	Mode of poisoning					
	Therapeutic			Accidental		
	1	2	3	4	5	6
Case						
Age in months	3	5	5	27	30	36
Pyrexia	+	+	+	-	+	-
Acetone breath	-	-	-	-	-	+
Abnormal respiration	+	+	+	+	+	+
Irritability or convulsions	+	-	-	-	+	-
Depression or coma	-	+	+	-	-	+
Emesis	-	-	+	-	+	+
Dehydration	+	-	+	-	-	-
Cyanosis	+	-	-	-	-	-
Abdominal pain or distension	+	-	+	-	-	+
Hemorrhagic tendency	?	-	-	-	-	-
Thirst	-	-	-	-	-	-
Polyuria	-	-	-	-	-	-

Once the presence of salicylate in the blood, urine, or spinal fluid has been proved, evidence of intoxication should be obtained. Changes in the acid-base balance are among those first noted. These have been summarized by Lipman, Krasnoff, and Schless (6) as follows:

Phase 1. Hyperventilation resulting from the stimulatory effect of salicylate on the respiratory center causes a decrease in the blood CO<sub>2</sub> concentration, altering the ratio of H<sub>2</sub>CO<sub>3</sub> to a bicarbonate in the direction of increased alkalinity. Respiratory alkalosis results. Compensation is rapidly brought about by the excretion of excess bicarbonate in the urine. At this stage the urinary pH is alkaline.

(4) See reference footnote (2) p. 20.

(5) Dubow, E., and Solomon, N. H.: Salicylate tolerance and toxicity in children. *Pediatrics* 1: 495-503, Apr. 1948.

(6) Lipman, B. L.; Krasnoff, S. O.; and Schless, R. A.: Acute acetylsalicylic acid intoxication; report of 5 cases with 2 deaths. *Am. J. Dis. Child.* 78: 477-483, Oct. 1949.

*Phase 2.* The next stage of intoxication is that of compensated acidosis. Salicylates interfere with carbohydrate metabolism and ketosis results. The alkaline reserve having already been lowered in the first phase, compensation is now maintained by the renal and blood buffer systems and insofar as possible by the respiratory defense of the pH (hyperpnea).

*Phase 3.* The final phase is that of decompensated acidosis with depletion of the alkaline reserve, decrease in the blood pH, and failure of the respiratory and renal buffering mechanisms in their attempt to achieve compensation.

Moderate as well as large doses of sodium salicylate regularly induce hypoprothrombinemia, which may regress spontaneously to some extent as treatment continues (7). This is most marked on the second to fifth day becoming normal however, by the eleventh day. Inadequate vitamin K intake, secondary to anorexia is probably also a contributing factor (8). The literature suggests that hypoprothrombinemia, although not the only cause, may be a contributing factor in the hemorrhages observed when salicylates have been given in large and repeated doses. Hemorrhagic manifestations occur in about one-fifth of nonallergic cases of salicylate poisoning (9).

Excluding idiosyncrasy, the amount of salicylates ingested and concomitant blood levels which are observed to cause clinical symptoms of poisoning show extremely wide variation from patient to patient. The uncertainty as to the lethal dose is reflected in amounts cited, particularly in textbooks on toxicology. Opinions varying from 3 to 30 grams, depending on the type of salicylate taken (2). The customary therapeutic dose of salicylates is 60 mg. per year of age every 4 hours, or about 40 mg. per kg. of body weight per day. Symptoms of intoxication usually ensue within 24 hours with from 2 to 4 times the above doses. Whereas about 1 gram per kg. was ingested by case 2 without marked toxicity, 0.35 gram per kg. was lethal in our one fatal case (case 3). Therefore, factors other than the amount ingested influence the occurrence of symptoms. A well child who accidentally ingests a relatively large amount of salicylates may not be as severely poisoned as a child receiving smaller amounts as an antipyretic during the course of a febrile illness. The explanation for this may be depletion of the glycogen reserve accompanying the original febrile illness accentuated by the increased metabolic rate and the loss of the normal stabilizing function of the liver in carbohydrate metabolism resulting from salicylate administration (10). Table 2 summarizes the pertinent

(7) Fashens, G. J., and Tolker, J. N. Salicylate intoxication, studies on effects of sodium salicylate on prothrombin time and alkali reserve. Am. J. Dis. Child. 66: 362-374, Dec. 1944.

(8) Govan, C. D., Jr.: Effect of salicylate administration on prothrombin time. J. Pediat. 29: 629-636, Nov. 1945.

(9) See reference footnote (2), p. 116.

(10) Dodd, K.; Vinot, A. S.; and Asnes, J. M. Salicylate poisoning: explanation of more serious manifestations. Am. J. Dis. Child. 53: 1435-1446, June 1937.

data from our cases and illustrates these mechanisms of salicylate intoxication.

TABLE 2. Summary of pertinent data on 6 patients with salicylate poisoning

	Mode of poisoning					
	Therapeutic			Accidental		
Case	1	2	3	4	5	6
Age in months	3	5	5	27	30	36
Weight in kilograms	5	6	6.5	11	12	16
Total amount of salicylate ingested (grams)	2.0	6.3	2.3	?	?	3.6
Salicylate ingested in grams per kg. of body weight	0.40	1.05	0.35	-	-	0.22
Initial blood level of salicylate (mg. per 100 cc.)	42	-	86	30	60	49
Phase of poisoning on admission	2	-	3	2	2	2
Prothrombin time on admission (control 17 seconds)	55	-	-	-	17	25
Number of hospital days urine was positive for salicylate	3	2	-	-	4	2

Profound salicylate intoxication is one of the most refractory conditions which is met in everyday practice. Better to initiate and maintain appropriate therapy, the effects of salicylates on the body and the ensuing secondary complications must be recognized as they arise. Early treatment includes gastric lavage with tap water before hyperpnea ensues. Parenteral dextrose should be started in the early phases to maintain fluid balance and to combat hypoglycemia and ketosis (11). The metabolic acidosis of the second and third stages of salicylate intoxication tends to be fixed and difficult to correct. The choice of salt solution varies with individual patients (12). The administration of vitamins K and C, oxygen, blood, and plasma are useful adjuncts to therapy. Lumbar puncture and sedation may be necessary to combat fever and convulsions. Any pre-existing infection must not be disregarded, but caution should be used in prescribing any medicaments possibly toxic to an already potentially damaged renal system. As is illustrated by case 3, salicylate intoxication may be irreversible even though known physiologic aberrations are corrected, probably because of enzyme poisoning (11).

(11) Hartmann, A. F.: Symposium on rheumatic fever; acute salicylate poisoning. *J. Pediat.* 26: 214-215, Mar. 1945.

(12) Specter, S., and McKhann, C. F.: Respiratory acidosis and alkalosis in children. *J. Pediat.* 32: 227-245, Mar. 1948.

## CONCLUSIONS

Salicylate intoxication is easily missed by both clinician and pathologist unless a strong index of suspicion as to its possible presence is maintained. Because salicylate intoxication in infancy is usually the result of prescribed medication, physicians are warned to be cautious when prescribing salicylates for this age group.

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## BOOK REVIEW

*A Citizen's Handbook of Sexual Abnormalities and The Mental Hygiene Approach to Their Prevention, A Report of the Governor's Study Commission on Sex Deviates*, by Samuel R. Hartwell, M. D., Assistant Director of the Michigan Department of Mental Health; Member of the Governor's Study Commission on Sex Deviates. 70 pages. Public Affairs Press, Washington, D. C., publisher, 1951. Price \$1.

This pamphlet on a vital subject is well written and timely. It is based on the findings of the Governor's Study Commission on the Deviated Criminal Sex Offender of the State of Michigan. The Commission was made up of committees on (1) resources and present practices, (2) fact finding, (3) legislation, (4) education, and (5) moral and spiritual values. The subject is presented in popular style for wide distribution among thinking but nonprofessional citizens. It gives every indication that the people of Michigan are anxious to deal with an old and universal problem without hysteria or preconceived ideas and have made encouraging steps in the direction of its solution. The author has wisely devoted the greater part of this booklet to the mental hygiene of sex stressing the normal psychosexual development of the child and avoiding sensationalism. Disputed questions are discussed and prevalent but fallacious ideas are exposed to the light of current knowledge. The final section is devoted to the practical but difficult measures which show the greatest promise of ameliorating the problem. Because an understanding of the nature of sex behavior, both normal and abnormal, is the first and perhaps most important step in preventing deviations from the normal, this pamphlet should be especially helpful to parents of small children but the material contained in it should be available to everyone. Here at last is a book that gives the average citizen the "facts of life"—not the time-honored facts of the physiology of reproduction but the facts of the development of the emotional reactions to the various levels of the awareness of sex.—Col. W. G. Brandstadt, MC, U. S. A.

# Medical Benefits and Disability Compensations for National Guard Personnel

*Arthur L. Streeter, Colonel, U. S. A. F. (MC) (1)*

**T**HE following discussion is given in an effort to acquaint the Medical Service personnel of the Armed Forces with the medical benefits and disability compensations to which National Guardsmen are entitled by law. During my 5 years (1946-1951) as Air Surgeon, National Guard Bureau, misunderstanding of the medical benefits authorized for the National Guard arose frequently. This discussion applies equally to the Army and the Air National Guard.

A National Guardsman is entitled to medical benefits and disability compensations while undergoing inactive duty training under Sections 92, 94, 97, and 99 of the National Defense Act of 1916, as amended. The types of training included are (2):

1. Armory drill, or unit training assembly as it is known in the Air National Guard. This is a weekly training period of at least 2 hours' duration. Recently, provisions have been made to allow for a single 8-hour day of training to be credited as 2 training periods.
2. Field training encampment. This is a period of at least 2 weeks of full-time training, and is usually held at a site away from the home station. It normally brings larger units together. Included in this section are various other exercises, such as gunnery meets.
3. Service school training which is attendance at a school conducted by the Armed Forces.

The basic law, on which the current medical benefits for the National Guard rest, is the Act of Congress of 1936 (3). This law provides:

"That officers, warrant officers, and enlisted men of the National Guard who suffer personal injury or contract

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(1) Mitchel Air Force Base, New York.

(2) 32 U. S. C. 32, 63, 64, 144, 146.

(3) Act of June 15, 1936 (49 Stat. 1507; 32 U. S. C. 164a, 164b, 164c).

disease in line of duty while en route to or from or during their attendance at encampments, maneuvers, or other exercises, or at service schools, under the provisions of sections 94, 97, and 99 of the National Defense Act of June 3, 1916, as amended \* \* \* shall, under such regulations as the President may prescribe, be entitled, at Government expense, to such hospitalization, rehospitalization, medical and surgical care, in hospital and at their homes, as is necessary for the appropriate treatment of such injury or disease, until the disability resulting from such injury or disease cannot be materially improved by further hospitalization or treatment, and during the period of such hospitalization or rehospitalization, but not for more than an aggregate of six months after the termination of the prescribed tour of active duty or training in any case to the pay and allowances, whether in money or in kind, that they were entitled to receive at the time such injury was suffered or disease contracted, and to the necessary transportation incident to such hospitalization and rehospitalization and return to their homes when discharged from hospital; and for any period of hospitalization or when they are not entitled to pay and allowances under the preceding provision, they shall be entitled to subsistence at Government expense \* This law further provides that, "Officers, warrant officers, and enlisted men of the National Guard who suffer personal injury (as distinguished from disease) in line of duty when participating in aerial flights prescribed under the provisions of section 92 of said National Defense Act as amended shall, under regulations prescribed as aforesaid, be entitled to the same hospitalization, rehospitalization, medical and surgical care, pay and allowances, and transportation, as if such injury had been suffered while in line of duty during their attendance at encampments, maneuvers, or other exercises, or service schools, under the aforementioned sections 94, 97, or 99 of the National Defense Act of June 3, 1916, as amended; \* \* \*."

Although hospitalization is authorized for an indefinite period of time, that is, until maximum improvement has been reached, the pay is limited to an aggregate of 6 months. The guardsman on army drill, or unit assembly training, is covered by this law only for injury incurred in a military aircraft accident.

The Act of Congress of October 14, 1940 (4), which amends the Act of July 15, 1939 (5), further extends the coverage to allow medical bene-

(4) Section 5, Act of October 14, 1940 (54 Stat. 1137, 32 U. S. C. 1643).

(5) Act of July 15, 1939 (53 Stat. 1042, as amended, 32 U. S. C. 1641).

sits for diseases contracted or injuries sustained *not* in line of duty for the period of training only; provided, such disease or injury was not incurred while on armory drill (except on an aerial flight). A disease or injury incurred *not* in line of duty while the guardsman is on a pass of 24 hours or more may not be treated by a civilian physician at government expense nor may the guardsman be hospitalized in a civilian hospital at government expense for such a cause. This law allows the treatment of diseases or injuries which were incurred prior to the beginning of the period of training, but does not authorize such treatment or hospitalization at the expense of the Government after the end of the training period. If a guardsman is in the hospital at the end of his training period for a condition determined to have been incurred *not* in line of duty, it is his responsibility, unless his State pays the bill for him, to reimburse the Federal Government for the hospitalization allowed him after the end of the training period.

The Act of Congress of 1949 (6) extended the medical benefits for National Guard personnel still further. It stated:

"SEC. 3. All officers, warrant officers, and enlisted men of the National Guard of the United States, both ground and air, the federally recognized National Guard of the several States, Territories, and the District of Columbia—

(1) if engaged for periods in excess of thirty days in any type of training or active duty under sections 5, 81, 92, 94, 97, or 99 of the National Defense Act, as amended, suffer disability or death in line of duty from disease while so engaged; or

(2) if engaged for any period of time in any type of training or active duty under such sections of the National Defense Act, as amended, suffer disability or death in line of duty from injury while so employed,

shall be in all respects entitled to receive the same pensions, compensation, death gratuity, retirement pay, hospital benefits, and pay and allowances as are now or may hereafter be provided by law or regulation for officers and enlisted men of corresponding grades and length of service of the Regular Army."

This law made no mention of burials or of treatment for diseases contracted while on training periods of less than 30 days, but its provisions did not supersede all those of the earlier laws mentioned above. Therefore, burials and treatment for diseases contracted while on training periods of less than 30 days are still authorized by the Act of 1936 and treatment for diseases or injuries incurred *not* in line of duty are allowed by the Act of 1940. This law also removes the 6-month limitation on his pay while a guardsman is hospitalized. When Public Law 108 (6) was passed, there were 108 Air National Guard

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(6) Section 3, act of June 20, 1949 (Public Law 108, 81st Congress; 63 Stat. 202, 32 U. S. C. 16n).

personnel—mostly pilots killed in military aircraft accidents—and several Army guardsmen who had died in line of duty since the reorganization of the National Guard in 1946. Fortunately, the provisions of this Act were made retroactive to 14 August 1945 so their beneficiaries as well as those of guardsmen who subsequently died are entitled to the 6 months' pay death gratuity and to pensions the same as the beneficiaries of members of the Regular components of the Armed Forces.

The Career Compensation Act of 1949 (7) authorized disability retirement or severance pay benefits for guardsmen who, while on a training status, incur physical disabilities as a result of injuries and are otherwise qualified under that Act. To date only 2 Air National Guard officers and no Army National Guard personnel have been retired under the provisions of this law. Both were injured in military aircraft accidents. While these 2 officers were in the hospital they received full pay and allowances under Public Law 108 (6) even though their hospitalization extended beyond the 6-month period formerly allowed under the Act of 1936.

The latest Act of Congress, affecting the National Guard (8) provides the \$10,000 indemnity for National Guard personnel who die while in a training status in the same manner as for members of the Armed Forces on active service. Although this law is retroactive to 27 June 1950, such National Guard personnel must have been called or ordered to active duty or active training duty for 14 days or more in order to qualify for such indemnity other than such personnel engaged in aerial flights in Government aircraft for any period, with or without pay, as an incident to their military training.

One category of National Guard personnel who are not covered by the foregoing provisions are the caretakers and air technicians while on full-time duty as civilian employees. This duty, however, does not preclude such personnel from the foregoing provisions during the periods while on National Guard training status. When disabled while on duty as civilian employees they are beneficiaries of the Bureau of Employees Compensation, the same as Civil Service employees.

It is hoped that the foregoing discussion will answer many of the questions which may arise in the minds of Armed Forces hospital commanders when asked to admit National Guard personnel for outpatient treatment or hospitalization. In all cases the guardsman should have a written request from his unit commander or surgeon for such treatment or admission. In emergencies this authorization may be submitted after the admission.

(7) Section 402, act of October 12, 1949 (Public Law 351, 81st Congress, 63 Stat. 817, 37 U. S. C. 272).

(8) Act of April 25, 1951 (Public Law 23, 82nd Congress, AF Bulletin 20, 1951).

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The Approach to Cardiology, by Crighton Bramwell, M. S., M. D., F. R. C. P., Professor of Cardiology in the University of Manchester, Physician to the Manchester Royal Infirmary, Formerly Professor of Systemic Medicine in the University of Manchester, Senior Censor of the Royal College of Physicians of London, Examiner in Medicine to the University of Cambridge, Edinburgh, Durham, Aberdeen, and Sheffield, with a foreword by A. V. Hill C. H. G. B. L., Sc. D., F. R. S., Foulerton Research Professor of the Royal Society. 122 pages, illustrated. Geoffrey Cumberlege, Oxford University Press, New York, N. Y., publisher, 1951. Price \$4.75.

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WAYNE G. BRANDSTADT, *Editor-in-Chief,*  
*Colonel, Medical Corps,*  
*United States Army.*

ROBERT J. BENFORD, *Associate Editor,*  
*Colonel, Medical Corps,*  
*United States Air Force.*

WILLIAM R. WHITEFORD, *Associate Editor,*  
*Captain, Medical Corps,*  
*United States Navy.*



VOL. III

FEBRUARY 1952

NO. 2

# UNITED STATES ARMED FORCES MEDICAL JOURNAL

*Published Monthly by the Armed Forces Medical Publication  
Agency, Department of Defense*



WAYNE G. BRANDSTADT, Colonel, MC, U. S. A., Editor-in-Chief  
ROBERT J. BENFORD, Colonel, U. S. A. F (MC), Associate Editor  
WILLIAM R. WHITEFORD, Captain, MC, U.S.N., Associate Editor

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THE PRINTING OF THIS PUBLICATION HAS BEEN APPROVED BY  
THE DIRECTOR OF THE BUREAU OF THE BUDGET, OCT. 19, 1949

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UNITED STATES  
GOVERNMENT PRINTING OFFICE  
WASHINGTON 1952

For sale by the Superintendent of Documents, U. S. Government Printing Office  
Washington 25, D. C.

## Foreword

The UNITED STATES ARMED FORCES MEDICAL JOURNAL represents the unification of the BULLETIN OF THE UNITED STATES ARMY MEDICAL DEPARTMENT and the UNITED STATES NAVAL MEDICAL BULLETIN. This joint periodical is the medium for disseminating information of administrative and professional interest to all medical personnel of the Department of Defense.

The Chairman of the Armed Forces Medical Policy Council and the Surgeons General of the several services invite all medical officers, dental officers, Medical Service Corps officers, Nurse Corps officers, and officers of the Veterinary Corps of the Armed Forces, and the medical consultants of the Army, Navy and Air Force to submit manuscripts for publication in this JOURNAL.

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GEORGE E. ARMSTRONG,

*Major General, U. S. A.,  
Surgeon General, U. S. Army*

LAWTON FLETCHER,

*Rear Admiral, MC, U. S. N.,  
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*Major General, U. S. A. F.,  
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# Manual Artificial Respiration

D. B. Dill, Ph. D. (1)

**I**N January 1950 the Secretary of Defense requested the medical services of the Armed Forces to revise the training manuals on the treatment of casualties from chemical warfare agents. A committee of three officers was assigned this responsibility. Because the need for artificial respiration in nerve-gas casualties had been clearly recognized, as was announced in June 1950 (2), the committee decided that methods for manual artificial respiration should be included in the manual and proceeded to review the evidence on which their decision was to rest. Their review of the literature revealed doubts about the Schafer prone pressure method, almost universally used in this country. Comroe and Driggs (3) had published observations on patients which indicated that a higher pulmonary ventilation could be obtained in a "push-pull" method (the Eve tilting method) than in the Schafer method which depends on "push" alone. In 1947 the Council on Physical Medicine of the American Medical Association, at the request of the American Red Cross, reviewed the problem and reported that the prone pressure method was inferior to certain other methods, but recommended that further study be made before selecting a method to be adopted.

In September 1950 a meeting was held at the Army Chemical Center. The medical services of the Armed Forces were represented by officers familiar with design and procurement of equipment and by the officers responsible for research and development as related to equipment and to methods of treatment. A group of physiologists which included outstanding experts in the field of respiration participated. Representatives of the Red Cross and 7 equipment manufacturers also took part. Although 2 push-pull methods of artificial respiration (4-6) were reported to have merit, further research was deemed necessary. With the support of the

(1) Scientific Director, Chemical Corps Medical Laboratories, Army Chemical Center, Md.

(2) Tood, J. R.: Medical problems in chemical warfare. *J. A. M. A.* 144: 606-609, Oct. 21, 1950.

(3) Comroe, J. H., Jr., and Driggs, R. D.: Artificial respiration. *J. A. M. A.* 130: 391-383, Feb. 16, 1946.

(4) Nielsen, H.: Method of resuscitation. *Ugesk. f. Laeger.* 94: 1201-1203, Dec. 15, 1932.

(5) Treatment of Chemical Warfare Casualties. TM 8-285, NAVMED P-1328, AFM 160-12. Departments of the Army, the Navy, and the Air Force, August 1951.

(6) Tood, J. R.; Dickens, P. F., Jr.; Rizzolo, J.; and Bayliss, M. W.: Treatment of nerve-gas casualties. U. S. Armed Forces M. J. 2: 1609-1617, Nov. 1951.

Armed Forces several potential investigators were invited to a planning meeting in Washington on 8 November. I was asked to preside at this meeting and to act as coordinator of the research program to be initiated. Developments during the next year illustrate the potentialities of close collaboration between military research agencies and nonmilitary laboratories.

### THE RESEARCH PROGRAM

At the meeting of 8 November 5 methods for manual artificial respiration were considered. These included one "push" method (Schaefer) and four "push-pull" methods. In one of these, the *Silvester*, the victim is supine; in the others he is prone. Brief descriptions of these methods adapted from Gordon, Fainer, and Ivy (7) follow:

*Schaefer (prone pressure) method.* The patient is placed in the prone position with his arms extended and his face to one side. Pressure is exerted with the operator's hands close together on the lower portion of the patient's thorax. This causes active expiration, when the hands are removed inspiration occurs because of elastic recoil.

*Silvester method.* The patient is placed in the supine position with his arms at his sides and his forearms and hands on the lower part of his thorax. His arms are raised, straightened, and extended over his head to effect active inspiration. His hands are then returned to their original position and pressure is exerted on his thorax to produce active expiration.

*Back-pressure hip-lift (hip-lift back-pressure, or Schaefer-Emerson-Ivy and Thompson) method.* With the patient prone, lifting and lowering his hips is alternated with pressure exerted on the lower part of his thorax. This method was described by Thompson (8) who used it for 8 hours on a paralyzed poliomyelitis victim, the Schaefer method having proved inadequate.

*Back-pressure hip-roll method.* This is a variant of the back-pressure hip-lift method described above. The patient is grasped at the distant hip and rolled onto the operator's knee.

*Back-pressure arm-lift (Nielsen, Holger-Nielsen, or arm-lift back-pressure method).* The patient is placed in the prone position with his hands under his forehead. Pressure is exerted over his midback, just below his shoulder blades to effect exhalation. His elbows are then grasped and raised, arching his back enough to relieve the weight on his chest, air is thus sucked into his lungs.

(7) Gordon, A. S., Fainer, D. C.; and Ivy, A. C. Artificial respiration, new method and comparative study of different methods in adults. *J. A. M. A.* 144: 1455-1464, Dec. 23, 1950.

(8) Thompson, T. C. Method of artificial respiration especially useful for paralyzed patient. *J. A. M. A.* 104: 307-309, Jan. 26, 1935.

The above methods were compared using (1) apneic hospital patients, (2) student volunteers, and (3) anesthetized and curarized volunteer subjects (9). As a result the investigators, Dr. Comroe, Karpovich, Gordon, and Whittenberger, agreed in April 1951 that the two methods of choice were the back-pressure arm-lift and the back-pressure hip-lift, the back-pressure arm-lift method being preferred. They emphasized that the success of any method depends on thoroughness of indoctrination and they recommended that the details of the techniques for the two recommended methods be given further attention.

Air-flow patterns were to be observed in the two recommended methods as applied to apneic human volunteers. A pedagogic study on a large number of enlisted personnel, using the same two methods and variations of them, was approved. With the help of the U. S. Naval Training Center, Great Lakes, Ill., the two methods of choice were tried out on a large number of naval personnel. All observations were completed within a month of the time the proposal was made—a remarkable record of efficient administration on the part of the Office of Naval Research and of effective collaboration between a group of university scientists and a military training center. On the strength of all the evidence accumulated, including Gordon's highly important blood gas studies on apneic volunteers while manual artificial respiration was being applied, it was unanimously agreed that the back-pressure arm-lift method should be given first preference and the back-pressure hip-lift method, second.

#### PUBLICATION OF FINDINGS

Following a meeting in June 1951 the investigators set about completing their papers for publication. Abstracts were prepared for presentation at the meeting of the American Physiological Society held in September. A Medical Laboratories Research Report was prepared (10). The completed papers were published together in a single issue of the *Journal of Applied Physiology* (11-20). A summarizing article for the

(9) Gordon, A. S.; Raymon, F.; Sadove, M.; and Ivy, A. C.: Manual artificial respiration, comparison of effectiveness of various methods on apneic normal adults. *J. A. M. A.* 144: 1447-1452, Dec. 23, 1950.

(10) Dill, D. B., Comroe, J. H., Jr., Whittenberger, J. L., Gordon, A. S., and Karpovich, P. V.: Manual artificial respiration. Medical Laboratories Research Report No. 79. Chemical Corps Medical Laboratories, Army Chemical Center, Md., Aug. 1951.

(11) Sadove, M. S.; Gordon, A. S.; Nelson, J. T., and Ivy, A. C.: Barbiturate-curare-induced apnea for artificial respiration studies on normal adults. *J. Appl. Physiol.* 4: 403-407, Dec. 1951.

(12) Gordon, A. S.; Affeldt, J. E.; Sadove, M. S.; Raymon, F.; Whittenberger, J. L.; and Ivy, A. C.: Air-flow patterns and pulmonary ventilation during manual artificial respiration on apneic normal adults. *J. Appl. Physiol.* 4: 408-420, Dec. 1951.

(13) Gordon, A. S.; Prez, O.; Wedell, H.; Sadove, M. S.; Raymon, F.; Nelson, J. T.; and Ivy, A. C.: Circulatory studies during artificial respiration on apneic normal adults. *J. Appl. Physiol.* 4: 421-438, Dec. 1951.

(14) Gordon, A. S.; Raymon, F.; Sadove, M. S.; Wedell, H.; and Ivy, A. C.: Energy expenditure of operators during manual artificial respiration. *J. Appl. Physiol.* 4: 439-446, Dec. 1951.

Journal of the American Medical Association (21) was prepared. The latter contained conclusions and recommendations with descriptions of the methods of choice.

The conclusions and recommendations found in the Medical Laboratories Research Report (10) were approved by the Armed Forces Medical Policy Council on 5 November 1951.

### PRESENTATIONS TO NONMILITARY AGENCIES

At a conference held in October under National Research Council auspices and attended by representatives of the Armed Forces, Boy Scouts, Girl Scouts, Y. M. C. A., public utilities, and civilian defense organizations, synopses of the findings of the investigators were presented. This presentation led to the subsequent wide-scale adoption of the back-pressure arm-lift method of artificial respiration. A highly condensed version of the reports interpreted in the light of the ensuing discussion follows.

Dr. Comroe reported observations on 13 apneic patients. As a rule he found that the hip-lift and hip-roll techniques, combined with back-pressure, produced the greatest tidal volume. The Sylvester, the back-pressure arm-lift, and the Schaefer techniques followed in that order. He recognized that the hip-lift and hip-roll techniques are too exhausting for general use and endorsed the back-pressure arm-lift method as an acceptable compromise in that it produces much more ventilation than the Schaefer method, is less exhausting than the hip-lift or hip-roll techniques, and does not favor respiratory obstruction as does the Sylvester (supine) technic. In his subjects, the back-pressure arm-lift method did not produce hyper-ventilation as it did in Gordon's series. He urged, therefore, that it be used with a full arm lift, with firm pressure over the scapulas (not over the shoulders) if it is to achieve adequate pulmonary ventilation in most patients in need of artificial respiration. He had originally suggested that the rhythm be about 14 cycles per minute, but he accepted the others' recommendation that it be about 12 per minute.

(15) Gordon, A. S., Star, S., Meier, F., Hale, C., and Ivy, A. C. Pedagogical and performance factors of manual artificial respiration with naval personnel. *J. Appl. Physiol.* 4: 447-457, Dec. 1951.

(16) Karpovich, P. V., Hale, C. J., and Bailey, T. L. Pulmonary ventilation in manual artificial respiration. *J. Appl. Physiol.* 4: 458-466, Dec. 1951.

(17) Karpovich, P. V., and Hale, C. J. Energy expended in administering artificial respiration. *J. Appl. Physiol.* 4: 467-471, Dec. 1951.

(18) Karpovich, P. V., and Hale, C. J. Manual artificial respiration, pedagogical and fatigue factors involved in its use. *J. Appl. Physiol.* 4: 472-475, Dec. 1951.

(19) Thunissenberg, J. L., Ashfield, J. E., Goodale, W. T., and Saracoff, S. J. Mechanics of breathing in relation to manual methods of artificial respiration. *J. Appl. Physiol.* 4: 476-483, Dec. 1951.

(20) Sims, R. G., Comroe, E. H., Botelho, S. Y., and Comroe, J. H., Jr. Comparison of methods for performing manual artificial respiration on apneic patients. *J. Appl. Physiol.* 4: 486-493, Dec. 1951.

(21) Gordon, A. S., Sadove, I. S., Paymon, F., and Ivy, A. C. Critical survey of manual artificial respiration. *J. A. M. A.* 147: 1444-1453, Dec. 8, 1951.

During the discussion one of the representatives questioned the wisdom of giving up the Schafer method in view of the record of its success in saving lives. Dr. Comroe replied that while many lives could be saved by the Schafer method, more could be saved by the recommended methods. He opposed the philosophy of letting well enough alone. Acceptance of such a philosophy would have prevented, for example, the introduction of sulfonamides in the treatment of pneumonia and their replacement in turn with still more effective antibiotics.

Dr. Whittenberger reported observations on 8 apneic patients in which 3 manual methods were compared. In 6 of these patients the cause of apnea was massive intracranial hemorrhage. His results showed more than adequate ventilation with the back-pressure hip-lift method, adequate but somewhat less ventilation with the back-pressure arm-lift method, and slightly less than adequate ventilation with the Schafer method. From analysis of the air flow patterns and comparison of technic with other operators, he concluded that the potential of the back-pressure arm-lift method is not fully utilized *unless the arms are well lifted*.

Considering not only the effectiveness of ventilating the lungs but ease of performance and other factors, he concluded that the back-pressure arm-lift and back-pressure hip-lift methods are equally sound physiologically, the preference going to the former method for practical reasons. The Schafer method is not recommended.

A hospital case he described is of special interest:

A 66-year-old man was admitted with a history of unconsciousness for  $2\frac{1}{2}$  hours. He was alleged to have taken paraldehyde and one barbiturate capsule. He had had several previous admissions for alcoholism, bronchial asthma, and pulmonary emphysema and fibrosis. On admission he was comatose, cyanotic, and apneic. Multiple doses of caffeine, coramine, and picrotoxin had no effect. Artificial respiration was applied to the patient in the sitting position by anterior chest compression. The cyanosis persisted. The patient was then put in the prone position and the hip-lift method applied by 2 men using a sheet under the hips. The cyanosis disappeared in 5 minutes. An additional dose of picrotoxin was then followed by gradual respiratory efforts of the patient. Manual application was continued for 30 minutes. The patient recovered with no apparent sequelae.

Dr. Karpovich paid special attention to fatigue, energy requirement, ease of learning and other pedagogic factors. He also measured pulmonary ventilation when artificial respiration was superimposed on the normal respiration. His measurements showed that the Schafer method gave only about one-half the pulmonary ventilation given by the push-pull methods. The energy requirement was measured on operators of both sexes and on victims of varying body weight. All operators complained that the hip-lift method was most fatiguing. Yet there was no associated

clear-cut difference in the operators' oxygen consumptions. Evidently the fatigue complained of was due to local stresses, especially of the shoulder muscles.

Dr. Karpovich's pedagogic study was done on 2 groups of subjects consisting of 100 boys and 67 young men respectively. The students were divided into small groups and each group was given instruction separately in one session. During another session they were required to execute each method for from 10 to 15 minutes. The order of methods was randomized with the exception of the hip-lift, which was always given at the end of the test. This was done because preliminary investigation showed that the hip-lift was unquestionably most fatiguing and its use before the execution of other methods would have caused an early fatigue and might have affected the experiment. The results led Dr. Karpovich to conclude that from the standpoint of ease of learning and operation the order of increasing difficulty is as follows: Schafet, back-pressure arm-lift, Silvestet, back-pressure hip-roll, and back-pressure hip-lift.

Dr. Gordon and his associates induced apnea in 50 normal adults using pentothal sodium and curare, partially supplemented with cyclopropane-oxygen mixtures (11). Working with Thuttenbetget and Affeldt (12) it was found that push-pull manual methods produce a tidal volume about double that given by the Schafet method. A crucial element in the technic of the back-pressure arm-lift method is that the arms must be raised until firm resistance is met. In a third and highly significant study, arterial oxygen saturations were obtained (13). In all the push-pull methods oxygenation of arterial blood was adequate. The detailed results on the Schafet and the back-pressure arm-lift methods are found in table 1. Ten trials on 7 subjects were carried out with the Schafet method. In 3 of these (5, 7, and 8) oxygenation was adequate. Second trials were not carried out on subjects 6 and 11 because of alarming cyanosis and the trial on subject 9 was discontinued before blood was drawn for the same reason. On the other hand, oxygenation was adequate in all 11 trials on these 7 subjects when the back-pressure arm-lift was applied.

In the final study Dr. Gordon's group collaborated with Dr. Karpovich's group in evaluating pedagogic and performance factors (15). They concluded as follows:

"Observations and rating of the performance of methods of manual artificial respiration by 667 Naval recruits and 124 Nurses revealed that both the back-pressure arm-lift and variations of the back-pressure hip-lift can be successfully taught to Naval recruits in relatively brief training sessions as used in this test.

"Of these methods, the back-pressure arm-lift surpasses all the variations of the hip method in accuracy of performance, ease of learning—as measured by the need for an amount of correction—and physical ease of performance.

"Among the hip methods, the back-pressure hip-lift, especially when an adjunct is used in its performance, is most easily learned and accurately performed. It is, however, physically harder to do than the hip rolls. Hip methods, unlike the arm method, result in greater fatigue for the operator when the subject is appreciably larger than the operator.

TABLE 1. *Arterial oxygen saturation during trials of manual artificial respiration on anesthetized, curarized normal volunteers*

Subject	Trial	Arterial oxygen saturation (percent)	
		Schafer method	Back-pressure arm-lift method
5	1	85	89
6	1	42	—
	2	•	91
7	1	87	100
	2	—	100
8	1	91	91
	2	—	91
9	1	•	93
	2	—	96
10	1	61	—
	2	50	89
11	1	52	89
	2	•	89

\*Discontinued because subject was cyanotic.

"Since these conclusions are based on monitors' ratings it is not surprising that the monitors themselves arrived at much the same judgments. In ranking the methods as easiest to learn, easiest to perform, easiest to correct, most correctly performed and all around best (considering ventilation, fatigue, teachability, and accuracy of performance), the monitors themselves consistently placed the back-pressure arm-lift method first; the back-pressure hip-lift method with adjunct was second, and the back-pressure hip-roll method with adjunct was last; the other two hip methods were always ranked either third or fourth."

After the foregoing evidence was presented and the methods demonstrated there was a general discussion. Nearly everyone agreed with the conclusions reached by the investigators. After the meeting was adjourned the investigators met with a number of National Research Council consultants to draft recommendations. It was agreed that the

rhythm should be about 12 per minute and that the expiratory phase should come first. The back-pressure arm-lift method was accepted as the preferred method. It was recognized, however, that under some circumstances, the back-pressure hip-lift method should be used, especially in case of an arm injury. Dr. Comroe pointed out subsequently that " \* \* \* people in charge of artificial respiration on beaches often have an unlimited supply of individuals who can give artificial respiration in relays (as soon as one gets worn out another can take over). Under such circumstances I think the hip-lift back-pressure method would be the method of choice, and certainly the one that I would want performed on me if I had been the victim of drowning."

Endorsement of the Silvester method was urged by one of the consultants. This method had been one of the first to be ruled out by the investigators; they considered that a supine position increases the danger of the tongue blocking the airway. Gordon et al. (7) in their study of warm corpses gave some attention to this question. In 8 cases a mouthpiece was used with the nostrils closed by a clip. This provided an airtight airway and at the same time permitted the tongue and mandible to remain free. In the back-pressure arm-lift and the back-pressure hip-lift methods there were no failures whereas in the Silvester method the airway was blocked in 4 of the 8 cases. Dr. Comroe subsequently addressed an inquiry to 35 well-known anesthesiologists in this country. He found that " \* \* \* the great majority of them favor the prone position as the position of choice to prevent respiratory obstruction in an unconscious patient. However, a few favor the supine, a few stated that there was no difference between the two positions; and several stated frankly that they did not know. A number of them indicated that there was really no accurate information upon this and their opinion was merely a guess." For the moment, however, it is concluded that the Silvester method should not be used unless circumstances prevent placing the victim in a prone position.

Finally the investigators and consultants endorsed instructions for the two preferred methods adapted from the Medical Laboratories Research Report (10). These, edited to conform to the modifications suggested, follow.

#### GENERAL PRINCIPLES OF MANUAL ARTIFICIAL RESPIRATION

Time is of prime importance. Seconds count. Do not take time to move the victim to a more satisfactory place; begin at once. Do not delay resuscitation to loosen clothes, warm the victim, nor to apply stimulants. These are secondary to the main purpose of getting air into the victim's lungs.

Begin artificial respiration and continue it rhythmically and uninterrupted until spontaneous breathing starts or the victim is pronounced "dead".

As soon as the victim is breathing by himself, or when additional help is available, see that the clothing is loosened (or removed, if wet) and the patient is kept warm, but do not interrupt the rhythmic artificial respiration to accomplish these measures.

If the victim begins to breathe on his own, adjust your timing to assist him. Do not fight his attempts to breathe. Synchronize your efforts with his.

*Do not wait for a mechanical resuscitator*, but when an approved model is available use it. The important advantages of good mechanical resuscitators are that they require less skill to operate, are not fatiguing, and can furnish 100 percent oxygen. Because a resuscitator need only be applied to the patient's face, it can be used when physical manipulation of the body is impossible or would be harmful, as during surgical procedures, in patients with extensive burns, broken vertebrae, ribs, and arms, for victims trapped under debris of excavations, or under overturned vehicles, and during transportation of the victim. Furthermore, some resuscitators signal when the airway is obstructed and provide an aspirator.

#### BACK-PRESSURE ARM-LIFT METHOD (PREFERRED)

Place the victim in the face-down (prone) position. Bend both his elbows and place one of his hands on the other. Turn his face to one side and place it on his hands.

Quickly sweep your fingers through his mouth to clear out froth and debris and bring his tongue forward.

Kneel at his head on your right (or left) knee. Place your knee close to his arm and just to the side of his head. Place your left (or right) foot near his elbow. If it is more comfortable, kneel on both knees, one on either side of the victim's head.

Place your hands on his midback just below his shoulder blades (fig. 1). Your fingers should be spread, with your thumbs pointed toward and an inch or two away from his spine. Rock forward and allow the weight of the upper part of your body to exert slow, steady even pressure downward on your hands (fig. 2). This forces air out of his lungs. Your elbows should be kept straight and the pressure exerted almost directly downward on his back. Do not exert sudden or too much pressure, nor place your hands high on his back or on his shoulder blades.

Release the pressure quickly. This is done by "peeling" your hands from his back without giving any extra push with the release.

Rock backward and allow your hands to come to rest on his arms just above his elbows (fig. 3). Although he may be grasped anywhere along his arms, the position just above his elbows is generally best. As you rock backward, draw the victim's arms upward and toward you. When doing this, do not bend your elbows; keep your arms straight and as you rock



Figure 1. Initial position.



Figure 2. Pressure phase. Note that the operator's arms are straight and nearly vertical.



Figure 3. Positioning the hands on the victim's arms near his elbows.

backward his arms will naturally be drawn upward and toward you. Put enough lift on his arms to feel resistance and tension at his shoulders. The arm lift pulls on his chest muscles, arches his back, and relieves the weight on his chest; air is thus sucked into his lungs (fig. 4).

Carefully replace his arms on the ground. Slide your hands to his midback. You are now ready to repeat the cycle.

Repeat this cycle about 12 times per minute to the rhythm of (1) press—(2) release—(3) lift—(4) release. Each of these phases takes about  $1\frac{1}{2}$  seconds, giving a constant, steady, uniform rate, at 5 seconds per cycle.



Figure 4. Lift phase. Note that the operator is leaning back with his arms nearly straight and that the victim's arms are raised enough to arch his back and partially raise his chest from the ground.

Remember that either knee, or both knees, may be used; or you may shift knees during the procedure with no break in the steady rhythm. Also note that you rock forward with the back-pressure and backward with the arm-lift. This rocking motion helps keep the rhythm, and adds to the ease of operation.

#### BACK-PRESSURE HIP-LIFT METHOD (ALTERNATE)

Place the victim in the face-down (prone) position with his elbows bent. Turn his face to one side and rest it on the back of one hand. His other hand is alongside and above his head.

Quickly sweep your fingers through his mouth to clear out froth and debris and bring his tongue forward.

Kneel on your right (or left) knee at the level of his hips. Straddle the victim and place your left (or right) foot on the ground near his opposite hip. Thus your left heel is directly opposite the kneeling knee.



*Figure 5. Initial position.*



*Figure 6. Pressure phase.*



*Figure 7. Positioning the hands on the victim's hips.*

Place your hands, with the fingers spread, on his midback just below his shoulder blades (fig. 5). Your two thumbs point toward each other and are 1 or 2 inches from his spine, with your fingers pointed outward. Lean forward and allow the weight of the upper part of your body to exert slow, steady, even pressure downward on your hands (fig. 6). This forces air out of his lungs. Your elbows should be kept straight and the pressure exerted almost directly downward. Do not exert sudden nor too much pressure, nor place your hands high on his back nor on his shoulder blades.



Figure 8. Lifting the hips. Note that the operator's arms are straight and that the hips are lifted about 6 inches from the ground.

Release the pressure by quickly removing your hands. This is done by "peeling" them from his back without giving an extra push with the release.

As you release, rock backward and allow your hands to come to rest on his hips. This will be several inches below his waist. Do not grasp his waist. Just slip your fingers under his hip bones where they touch the floor (fig. 7).

Lift both hips upward and toward you about 5 inches from the ground (fig. 8). This allows his abdomen to sag downward. His diaphragm descends and air is sucked into his lungs. Be sure to keep your arms straight as you lift. In this way you do the work of lifting with your shoulders and back instead of with your arms. Do not bend your elbows as you lift his hips.

Carefully replace his hips on the ground in their original position. Do not just drop them. You are now ready to repeat the cycle.

This cycle should be repeated about 12 times per minute to the rhythm of (1) press—(2) release—(3) lift—(4) release. Each of these phases takes nearly  $1\frac{1}{2}$  seconds, giving a constant, steady, uniform rate at about 5 seconds per cycle.

If the knee on which the procedure is begun becomes tired or uncomfortable, it is possible to switch to the opposite knee with practically no break in the steady rhythm. The best time for changing knees is immediately following the press—release phase.

You should continue the method as long as possible. If you become tired, you should continue the back-pressure phase alone, at a faster rate, resuming the hip-lift as soon as possible, or performing a hip-lift after each second, third, or fourth back-pressure, or as often as possible.

If a second person is available, he can take over with practically no break in the rhythm. He does this by coming in on the side opposite where you are kneeling. After one of the lift—release phases he begins the press—release while you move away. He should be in position by the time the next hip-lift phase of the cycle is due.

You must not depend on or spend time seeking any apparatus to supplement or assist these maneuvers, but if a belt, towel, ahut, or rope is available, it may be passed beneath the hips (*not* beneath the waist) and used for lifting. This adjunct should be grasped near his body as this prevents slipping which may occur if the ends are held. Except for the adjunct, the method is performed as described above.

The back-pressure hip-lift method can be performed from the standing position, but this is not advisable because it may result in back strain to the operator during the lift or excessive pressure on the victim's back during the back-pressure phase.

### CONCLUSIONS

The mechanism of action of nerve gases is such that manual artificial respiration will occupy an important role in the treatment of casualties from attacks with such a weapon. Furthermore, a fuller understanding of manual artificial respiration may well result in the saving of many lives in other military operations.

Prior to 1951 there was no adequate experimental basis for choosing methods of manual artificial respiration. Various investigators favored the "push-pull" principle over the Schafer method which depends on elastic recoil for the inspiratory phase.

A research program on manual methods was sponsored by the military medical services. As a result 4 outstanding groups of physiologists have recommended 2 methods, the back-pressure arm-lift method first and the back-pressure hip-lift method second. Instructions for their use are given. These methods were officially adopted by the Armed Forces Medical Policy Council. The outcome illustrates the potentialities of effective collaboration between scientists in universities and scientists and administrators in the armed services.

# Chondromalacia of the Patella<sup>(1)</sup>

Chalmers R. Carr, Commander, MC, U. S. N. (2)

John W. Haward, Lieutenant, MC, U. S. N. (3)

THE true frequency of chondromalacia of the patella may be underestimated. Nineteen malacic patellas were found in a series of 60 consecutive knee arthrotomies. The diagnostic criteria are now well established, but there is no unanimity of opinion as to optimum therapy. Our purpose is to add a series to the literature and to recount our immediate end results. Thirteen of our 19 patients had other derangements of the knee with the chondromalacia. Malacia alone was found in 6. Total patellectomy was performed in 10 of these patients; 9 were treated by excising the involved cartilage and smoothing the crater edges.

## HISTORICAL

The term chondromalacia was first used by Koenig (4) in 1924. In 1906 Buedinger (5) described the condition as "fissures of the patellar cartilage." In addition to the term chondromalacia, this abnormal softening of the cartilaginous undercovering of the patella has been described as traumatic chondritis, traumatic degeneration, traumatic fibrillous degeneration, traumatic degeneration of the articular cartilage, and traumatic osteochondritis. Apparently the frequency of this softening was little appreciated prior to 1926. Heine (6), in that year, reported a dissection of 2,002 cadavers in which he found that the degenerative changes in the knee joint occurred first and were most marked in the articular surface of the patella. A year later

(1) Read before the Northern California Chapter of the Western Orthopedic Association.

(2) At U. S. Naval Hospital, Oakland, Calif., when this article was written; now at U. S. Naval Hospital, National Naval Medical Center, Bethesda, Md.

(3) With Department of Orthopedic Surgery, U. S. Naval Hospital, Oakland, Calif., when this article was written, now at U. S. Naval Hospital, Portsmouth, Va.

(4) Koenig: Mikroskopische Beobachtungen am Knorpelgewebe mit ultraviolettem Licht, Verhandl. d. phys.-med. Gesellschaft. (Sitzungsberichte 10-15). 49: 160-162, 1924.

(5) Buedinger, K.: Ueber ablösung von Gelenkstellen und verwandte Prozesse. Deutsche Ztschr. f. Chir. 84: 311-365, 1906.

(6) Heine, J.: Arthritis deformans. Verhows Arch. f. path. Anat. 260: 521-563, 1926.

Aleman (7) reported 220 arthrotomies, in which he found 33 percent to have a focus of softening in the patellar cartilage. Darrach (8) later found 36 (23 percent) of 157 patients to have degenerative changes in the patellar cartilage. Hilzenauer (9), in 1,000 arthrotomies, reported a smaller incidence. Orne (10) found degenerative changes in the articular cartilage of the patella in 102 cadavers with presumed normal knee joints. In recent years Cave et al. (11) and Soto-Hall (12) reported an incidence of 7 and 18.5 percent respectively. These reports were concerned with patients undergoing arthroscopy in an age group comparable to that reported in this article.

In seeking the best surgical procedure, one must review the evidence for and against total patellectomy. In 1860, Puerz (13) removed a patella with an apparently satisfactory result and concluded that the patella was not essential to normal gait. Rynard (14) reported a patient with total patellectomy performed for a fracture of the patella by Alshmann in 1890, and stated that the patient recovered full joint function after the operation. Widespread use of this procedure for fractures of the patella coincides with the report of Brooke (15). He reported on 30 patients and stated that "the patella was a vestigial remains and actually a hindrance to complete joint efficiency." Licky (16) repeated these studies and obtained different findings from those of Brooke. He believed that the patella had a levitating effect on knee-joint function (1) by improving the angle of application of the quadriceps power, especially as it approached 180 degrees, (2) by acting as a fulcrum, and (3) by holding the tendon away from the central axis of the knee joint. Numerous other writers, notably Tippett (17), Bissell (18), and Dodd (19), reported good functional recovery following total patellectomy in the treatment of fractured patellas. In his report, Bissell stressed the necessity of meticulous suture of the medial expansion

(7) Aleman, O. Chondromalacia posttraumatica patellae. *Acta chir. Scandinav.* 63: 147-150, 1928.

(8) Darrach, W.: Internal derangements of knee. *Ann. Surg.* 102: 129-137, July 1935.  
(9) Hilzenauer, K. Zur Chondropathie der Patella. *Arch. f. orthop. u. Unfall-Chir.* 4: 614-618, 1935.

(10) Orne, A. Chondromalacia Patellae. *Acta chir. Scandinav.* 77: Supplementum 41, 1934.

(11) Cave, E. F., Rawe, C. P., and Yee, L. B. K. Chondromalacia of patella. *Surg., Gynec. & Obst.* 81: 445-450, Oct. 1945.

(12) Soto-Hall, R. Traumatic degeneration of articular cartilage of patella. *J. Bone & Joint Surg.* 27: 421-431, July 1945.

(13) Puerz. Quoted by Albert (V).

(14) Rynard. Quoted by Albert (V).

(15) Brooke, F. Treatment of fractured patella by excision. Study of morphology and function. *Brit. J. Surg.* 24: 733-747, Apr. 1937.

(16) Licky. Quoted by Albert (V).

(17) Tippett, G. O. Treatment of fractures of the patella by excision. *Brit. M. J.* 2: 525-526, Feb. 17, 1935.

(18) Bissell, A. H. Total removal of patella. *Am. J. Surg.* 40: 496, May 1935.

(19) Dodd, H. Fractured patella treated by excision of fragments. *Lancet* 2: 130-134, Mar. 15, 1930.

of the joint capsule, and repair of the traumatic rent in the capsule. Berkheiser (20) reported satisfactory results for patellectomy performed for arthritic changes in the knee joint. Wass and Davies (21) were less enthusiastic about this operation because a complete return of joint function did not result and a residual quadriceps weakness was present. They recommended the procedure for fractured patellas as superior to other methods of therapy. Additional reports of the foreign literature suggest that, although the procedure is not universally approved, it has been widely applied and is not in dispute. Because the condition of chondromalacia of the patella is a disabling derangement of the knee joint, one of two surgical procedures is to be used. If total patellectomy gives fair assurance of return to normal function and prevents further attrition in the joint, then its use is justified no matter how radical it may seem at the time.

#### PATHOGENESIS

Several tenable concepts have been advanced as to the pathogenesis of chondromalacia of the patella. Trauma to the patellar cartilage appears to be the primary factor as expressed by Buedinger (5). Peabody and Walsh (22) believed that the condition was of congenital origin. Bennett et al. (23) observed that knee joints obtained from patients, whose ages were greater than 20 years, manifested the changes of degenerative arthritis. From this, they concluded that the articular cartilage remained normal for only a short period of time following its complete maturation. Peabody and Walsh (22) believed, however, that in the second and third decade of life there is a great reparative capacity in the deep chondral layers. These deep layers have a good blood supply and a great capacity for fibrocartilaginous proliferation from underlying bone. Freund (24) believed that normally a joint cartilage requires friction and pressure to remain in a healthy condition. Variations of these normal stimuli, either to a greater or lesser degree than some indeterminate physiologic optimum was thought to be deleterious to the joint cartilage. Mueller (25) and Benninghoff (26) both demonstrated this by animal experimentation. These experiments

(20) Berkheiser, E. J.: Excision of patella in arthritis of knee joint. *J. A. M. A.* 113: 2302-2308, Dec. 23, 1939.

(21) Wass, S. H., and Davies, E. R.: Excision of patella for fracture, with remarks on ossification in quadriceps tendon following operation. *Guy's Hosp. Rep.* 91: 35-57, 1942.

(22) Peabody, C. W., and Walsh, F. P.: Surgery of knee joint derangements. *S. Clin. North America* 28: 1247-1275, Oct. 1948.

(23) Bennett, G. A.; Waioe, H.; and Bauer, W.: Changes in Knee Joint at Various Ages. Commonwealth Fund, New York, N. Y., 1942.

(24) Freund, E.: Joint cartilage under infraphysiologic ultraphysiologic and euphysiological demands. *Arch. Surg.* 39: 596-623, Oct. 1939.

(25) Mueller, W.: Experimentelle Untersuchungen über die Wirkung langdauernder Immobilisierung auf die Gelenke. *Ztschr. f. orthop. Chir.* 44: 478-488, 1923-1924.

(26) Benninghoff, A.: Experimentelle Untersuchungen über den Einfluss verschiedenartige mechanische Beanspruchung auf den Knorpel (Verhandlungen der soatomischen Gesellschaft). In *Anat. Anzeiger*, Ergänzungsheft 58: 194-215, 1924.

seemed to substantiate the theory that chondromalacia of the patella was caused by continuous friction under tension. Sundt (27) suggested that the primary cause was not injury to the patellar cartilage at all but was injury to the synovial membrane, which in time produced an abnormal type of synovial fluid. Because the articular cartilage is to a large extent nourished by the synovial fluid, an abnormal composition of this fluid would cause nutritional disturbances in the cartilage and lead to its eventual degeneration.

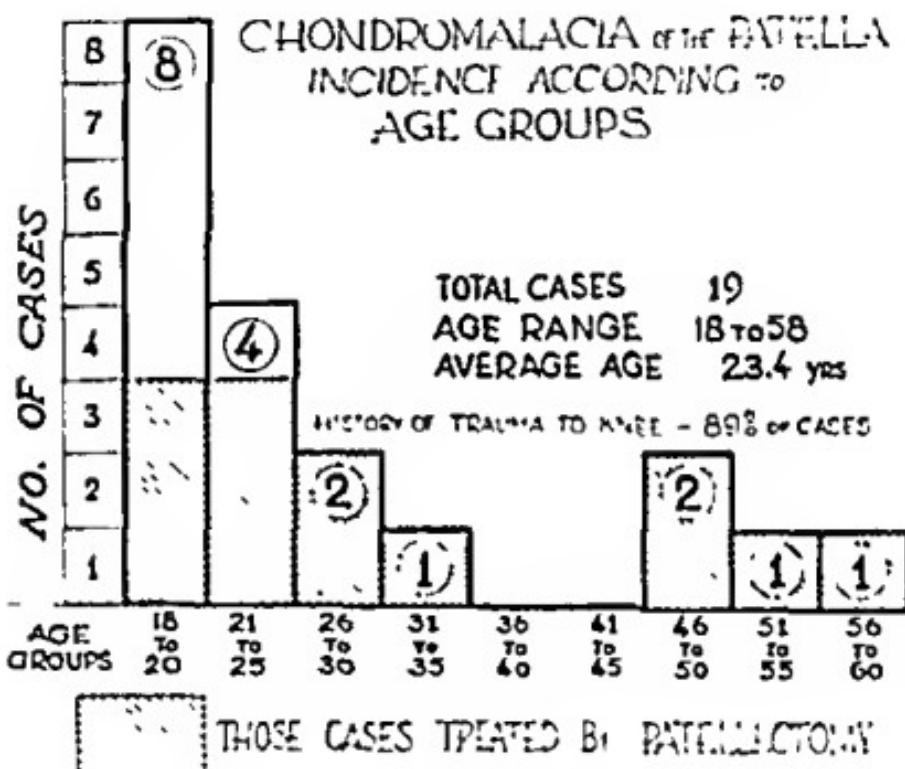


Figure 1.

In our 19 patients, whose ages are shown in figure 1, 17 gave a history of previous trauma to the knee joint. No further cause for this condition need be sought than trauma to a structure, poor in blood supply and with little regenerative power. In the patients in whom a history of definite trauma to the knee joint is absent, the aggregate effect of repeated episodes of mild trauma must have occurred and produced avascular necrosis of the underlying cartilage. The gross pathologic change present in chondromalacia is much different from the change seen with osteochondritis dissecans. In the latter a necrosis of subchondral bone, separation of the bone at one area of the

(27) Sundt, H.: Discussion following presentation of paper by Niels Søfteskiold on chondromalacia of the patella. Acta orthop. Scandinav. 9: 214-229, 1938.

cortex, and gradual degeneration and necrosis of the cartilage attached to the separated fragment occur. In chondromalacia, softening of the joint surface occurs first and sections taken through these areas will show a death of chondrocytes in the superficial layers and preservation of normal cartilage in deeper layers, with no involvement of the underlying bone structure. In the early lesions, fibrillation of the superficial layer of the cartilage is clearly evident. The deeper layer of cartilage becomes edematous, swollen, and contains relatively few chondrocytes. As the cartilage cells degenerate, they increase in size and appear to become piled up. Later they disappear and the empty lacunas of the cartilage become evident (figure 2). Although the cartilage is progressively reduced in thickness, the subchondral bone shows no great change until fully exposed. On exposure the marrow of the bone may exhibit marked degrees of fibrous proliferation.

There also may be evidence of abnormal osteoblastic and osteoclastic activity at the margins of the eroded area, with an occasional island of cartilage found in the marrow spaces of the subchondral bone. These malacic areas in the living knee joint are noted when the articular cartilage has lost its normal white to blue-white glistening translucent appearance and has become yellow, opaque, and soft. When a blunt instrument or the finger tip is passed over the involved area, the cartilage is felt to be soft and boggy, imparting the sensation that it might be detached from the subchondral bone. Fibrillation of the margins of the softened area is seen.

As the degeneration progresses, fissures and cracks appear in the cartilage and fragments may break off to form loose bodies in the joint or may remain as additional small fibrillated tufts. In the advanced cases, the subchondral bone may be exposed to the joint surface. Frequently, especially in chronic cases a similar "mirror" lesion may exist on the adjacent femoral condyle. When these two lesions pass over each other with joint motion, a grating sensation is produced. The feeling of insecurity frequently elicited as the main subjective symptom may be due to these lesions. In some cases small marginal osteophytes appear about the border of the patella relatively early in the disease. In all cases the synovial membrane of the joint shows evidence of long standing inflammation with hyperemia, thickening, and villose formation. Bronitsky (28) found the earliest detectable and most frequent site for these lesions to be the medial facet of the patella; next in frequency was the center of the patella; and least frequent, the lateral facet. Only in more advanced cases was involvement of the entire surface of the patella noted. In our experience, with the exception of those patients in whom the entire patella was involved, an area extending transversely across the center of the patella was involved in each instance.

(28) Bronitsky, J.: Chondromalacia patellae. *J. Bone & Joint Surg.*, 29: 931-945, Oct. 1947.



X 260



X 17

Figure 2. Microscopic sections. Chondrocytes are absent from the laminae and surface fibrillation is evident.

## SYMPTOMATOLOGY AND CLINICAL HISTORY

Most of our patients were admitted to the hospital with a spontaneous onset of pain and swelling in one of the knee joints. A careful history almost always elicited a positive statement as to previous trauma to that knee joint. The symptoms brought about by this condition are suggestive of several other types of mechanical derangement of the joint, and in fact associated lesions are often encountered, particularly those giving rise to instability of the knee joint; for example, relaxed and torn lateral and cruciate ligaments, loose bodies in the joint, and minor nonlocking injuries to one of the menisci. We freely admit that in many of our cases, the diagnosis was made in the operating room where the mechanical derangement expected was not found.

The pain is located at the medial joint line and beneath the patella. Associated with this there is often a sensation of weakness in the joint and instability with pseudolocking which is often difficult to differentiate from a true locking (such as is found in a joint containing a loose body or a ruptured meniscus). Pseudolocking may also be associated with a chronic sprain of the joint and resulting "weak knee" (29). True locking may occur when loose bodies are broken from the malacic cartilage and have become free within the joint. A feeling of insecurity is often experienced when climbing stairs or vertical ladders, or when ascending or descending a hill or an incline. The patient may call attention to a grating sensation beneath the patella, especially on forcible flexion or extension of the knee joint or on passive rubbing of the patella over the medial femoral condyle with the leg in full extension. Atrophy of the thigh is almost invariably present. Joint effusion is usually present to a moderate degree and can be increased by exercise. Not infrequently flexion and extension of the joint take place with a "ratchet" type of movement and are accompanied by pain and crepitus beneath the patella at some point in the arc between 90 and 180 degrees. We do not believe that the disability in chondromalacia is caused by loose fragments from the cartilage, causing a chronic synovial irritation, nor that the operation for the relief of this condition is a synovectomy. In most cases loose fragments were not found and there was no evidence on the surface of the cartilage that loose fragments had become dislodged from the patella or that removal of the inflamed synovia would eliminate the primary pathosis which seems to be evident in the patellar cartilage.

The physical signs can usually be correlated with the symptoms. If disruption of the collateral or cruciate ligaments is present antero-posterior or a lateral instability may or may not be demonstrated. "Locking" cannot be produced purposely by the examiner or by the examinee unless a loose body is present in association with malacia.

(29) Carr, C. R., and Hazzard, G. E.: Treatment of acute knee injuries, with special attention to "weak knee" syndrome. U. S. Nav. M. Bull. 42: 737-737, Apr. 1944.

## RADIOGRAPHIC APPEARANCE

Although radiographic changes have been reported, in none of our patients has roentgenographic examination been helpful. In chronic cases of long duration, associated with osteophytic production around the margins of the patella and overgrowth on the femoral condyles, some corroborative evidence of derangement within the knee joint may be found on roentgenographic examination. Only 2 of our patients showed any evidence of hypertrophic changes about the edges of

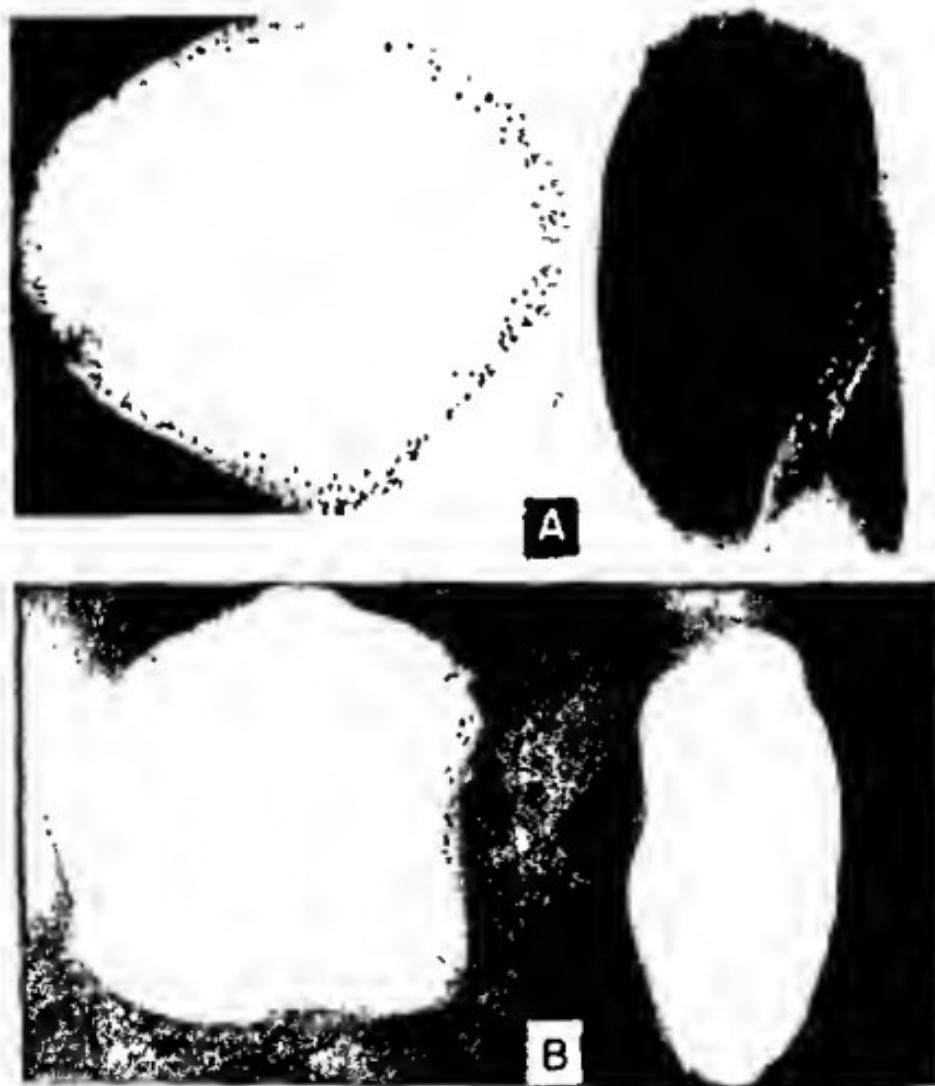


Figure 1. Roentgenographic appearance of excised patellas which at operation showed marked chondromalacia. No evidence of this is shown here. The small defect in the lateral margin of A was created by a tenaculum at time of operation.

the patella, and I showed some irregularity of the articular surface of the patella. In pre- and post-operative roentgenographic examinations of the patella, no diagnostic criteria could be predicated as characteristic of chondromalacia. Air arthrograms were not made in this study. Two of the excised patellas as shown in figure 3, were subjected to radiographic examination, and in these instances several competent roentgenologists found no definite diagnostic features of chondromalacia. Although roentgenographic examinations of all knees should be performed, the absence of abnormalities should not influence the diagnosis and the subsequent surgical treatment.

### SURGICAL TREATMENT

Good surgical management depends on adequate preoperative preparation of the patient. In all operations on the knee joint this includes instruction in the various forms of quadriceps exercises which will be carried out immediately after operation. These exercises are taught and, if the condition of the knee allows, are practiced for several days prior to operation. This establishes the proper pattern of exercise and muscle function in the patient's mind. This is an important factor in operations on the knee joint, particularly for unintelligent and emotional patients, who after operation may fail to use the knee. We have used horseshoe and median parapatellar incisions on these joints. In patients in whom we believe the diagnosis of chondromalacia is presumptive, but in whom other detanglements of the joint may be associated, we prefer the median parapatellar incision. The inverted horseshoe incision with reflection of the superior flap has some advantages and has been successfully used. Its use has been reserved for those patients in whom we decided to remove the patella. The median parapatellar incision must extend from the lower border of the vastus medialis to the attachment of the patella tendon on the tibial tubercle. The vastus medialis will usually have to be transected upward from its attachment to the rectus femoris, about 2 inches, to gain sufficient freedom in the quadriceps tendon to evert and inspect the patella. If patellectomy is decided on, the patella is grasped with a double tenaculum forceps and is excised by sharp dissection, leaving the tendon intact. This procedure is tedious as the expansion of the quadriceps tendon over the dorsum of the patella is quite thin and easily buttonholed. By frequent renewal of the knife blades and by working close to the bone, it can be successfully accomplished. When the patella is excised and the knee joint extended, the patellar tendon is much more relaxed than before. It is our custom to plicate the undersurface of the patellar tendon to fill this defect. The scar tissue which forms within this area will eventually produce an external appearance which resembles a normal knee. We use absorbable suture material for the deep repair and cotton or steel wire for the skin. Nonabsorbable material, however, will prove just as effective. With reefing the patellar tendon as described above and with the use of the

maximum amount of soft tissue, a cushion effect is afforded the femoral condyles and a more normal appearance of the knee in extension will result. After closing the wound, we apply a large pressure dressing from toes to groin, with moderate pressure over the patellar space, and maintain elevation of the limb for several days. In our earliest cases we supported what we believed to be the weakened patellar tendon by a posterior molded splint extending the full length of the extremity. We now believe that this is an unnecessary step and that there is little likelihood of a spontaneous or subjective rupture of the resected quadriceps mechanism. Those procedures which include a transectioned patellar tendon, such as is found in cases associated with comminuted fracture of the patella, or those associated with transverse exposure of the patella, require some support to prevent flexion of the leg for a period of from 14 to 21 days. Straight leg raising and quadriceps exercises are encouraged immediately. When the pressure dressing is removed, a plaster walking cylinder is worn until the twenty-first postoperative day. Albert (30) has advised active mobilization in 1 week or less. Dobbie and Ryerson (31) state that postoperative splinting is unnecessary.

In reviewing the postoperative course of several patients, we find that 2 of them started active flexion and extension exercises at the end of 11 and 12 days, respectively. The periods of convalescence in these cases were greatly shortened and return of joint function was much more rapid. In retrospect, we believe that we have been far too conservative in the postoperative treatment and might well speed up the patient's return to active duty by decreasing the period of postoperative immobilization.

Since this series was collected we have had the opportunity of performing 6 more patellectomies for this condition. These patients have been immobilized only in a pressure dressing and allowed to begin active knee exercises and weight bearing at will. As yet it is too early for their final evaluation, but we believe this is the better method.

### CASE REPORTS

**Case 1** A 32-year-old shipfitter was admitted on 9 February 1948 complaining of pain in the left knee of 9 years' duration. He had sustained a twisting injury to the left knee while playing basketball in 1939. Six months following this injury, the medial meniscus was excised. Following operation the patient continued to complain of a rubbing sensation in the knee and a feeling that something was slipping back and forth on the lateral side of the joint. The discomfort grew progressively worse and was aggravated by long standing and exercise.

(30) Albert, S. M. Excision of patella, preliminary report. *J. Iowa M. Soc.* 33: 154-157. Apr. 1943.

(31) Dobbie, P. P., and Ryerson, S. Treatment of fractured patella by excision. *Am. J. Surg.* 11: 312-313, Feb. 1942.

Physical examination revealed a three-fourth inch decrease in the circumference of the left thigh and one-half inch decrease in that of the left calf. There was moderate joint effusion, pain along the lateral aspect of the joint and a small tender mass, palpable just beneath the lateral collateral ligament. Roentgenograms of the knee were negative. On 29 March 1948 an arthrotomy was performed on the left knee and the patella excised because of large areas of chondromalacia



Figure 4 (case 1). Eight months following resection of left patella for chondromalacia.

involving its articular surface. A bucket-handle tear was found in the lateral meniscus and this was also removed. The knee was immobilized in a pressure dressing and the patient started on quadriceps exercises. Function in the knee returned progressively and on 3 May the patient began working 8 hours a day in the hospital brace shop. On 2 April 1949 he was returned to military duty with an asymptomatic knee which exhibited normal function except for a 15-degree limitation of flexion (fig. 4).

Case 2. A 25-year-old retired officer was admitted on 28 February 1949 complaining of pain in the left knee of 1 month's duration. There was no history of recent injury or evidence of inflammation or involvement of other joints. Recalling his past history, he stated that he

a blow to the knee in an airplane crash. The only other symptoms he noted were sharp needlelike pains in the knee joint on forced extension and an occasional buckling of the knee joint while walking, causing him to fall. Physical examination on admission was negative except for some discomfort on sliding the patella over the femoral condyles with the knee flexed. A roentgenographic examination of the knee joint revealed an area of rarefaction in the medial condyle. The patella appeared normal. On 7 March 1949 an arthrotomy was performed and the knee joint was found normal except for a marked chondromalacia of the articular surface of the patella. The patella was excised and the knee immobilized in a padded long-leg plaster cylinder for 3 weeks. In April 1950 the patient had a painless knee which could be extended to 180 degrees and flexed to 45 degrees. There was no quadriceps atrophy and the patient was able to participate in such activities as swimming, running, and dancing. He was seen by a physician postoperatively who did not believe the patella had been removed.

**Case 3.** A 47-year-old retired warrant officer was admitted complaining of pain and stiffness in his left knee of 1 month's duration. On admission his knee extended to 180 degrees and flexed to 100 degrees, was moderately swollen, and exhibited marked crepitus and pain beneath the patella. At arthrotomy a marked synovitis of fibrous character and chondromalacia of the patellar cartilage was found. The patella was excised and a moderate amount of synovia removed from the suprapatellar pouch. The postoperative progress was slow and when last seen, 15 months after operation, the patient had relatively little pain in the joint but could only extend to 170 degrees and flex to 115 degrees. He was in great need of vigorous quadriceps drill, which he admittedly had not been doing. He has been at home since the twelfth postoperative day. His result might have been enhanced if he had been under daily supervision. This limitation of motion did not prevent him from doing his regular work as an electrician. It is possible that the partial synovectomy at the time of operation accounts for the major portion of the limitation of flexion.

It has been our good fortune to re-explore the knee of a patient who had a total patellectomy about 19 months earlier. He had been wounded in the knee by shell fragments in 1943. At that time the patella was fractured and subsequently treated in a plaster cast. In January 1947, the patella was excised because it was chronically dislocated. The knee was explored again in September 1948 and a torn medial meniscus removed. At the operation it was noted that the remainder of the joint was entirely normal, with no evidence of erosion or undue wear and tear of the femoral condyles. This finding differs from that of Bruce and Talmley (32) in animals.

(32) Bruce, J., and Talmley, R. Excision of patella; some experimental and anatomical observations. *J. Bone & Joint Surg.* 24: 313-325, Apr. 1942.

## SUMMARY

Of 60 consecutive arthrotomies performed for various internal derangements of the knee joint, 19 were found to have the patellar cartilage involved by chondromalacia. Thirteen of these were associated with other derangements. In 10 of these total patellectomy was performed. It appears that satisfactory function and prevention of further degenerative changes result from the operation. A history of definite trauma was elicited in 89 percent of the cases.

## BOOK REVIEW

*The Effect of Hormones Upon the Testis and Accessory Sex Organs*, by Norris J. Heckel, A. B., M. D., Clinical Professor of Urology, Department of Surgery, University of Illinois College of Medicine; Chairman, Department of Urology, Presbyterian Hospital; Attending Urologist, Ravenswood Hospital and Neurotic Hospital; Consulting Urologist, Chicago Intensive Treatment Center, Chicago, Ill. Publication No. 110 American Lecture Series, A Monograph in American Lectures in Endocrinology. 73 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1951. Price \$2.25.

This monograph will have its chief use in bringing the clinician abreast of current knowledge in a field replete with complexities and attended by considerable confusion and difference of opinion. In clear and concise form, the author has developed his subject from the embryology of the male sex organs to the clinical application of the effects of certain hormones on them. Before considering the hormonal groups which influence the male reproductive organs, the anatomy, histology, and physiology of the testes are reviewed briefly. The gametogenic and endocrine functions of the testis are treated separately and a most complete classification of gonadic dysfunction presented. The brevity of the monograph precludes the inclusion of all the syndromes listed but the more common disorders of the male reproductive organs amenable to hormonal therapy are discussed. The history and salient features of fundamental investigations in this significant field are well described before the clinical applications of endocrine therapy are presented. The listing and consideration of the most valuable hormonal therapeutic preparations produced by the various commercial laboratories are of great practical value. The three hormonal groups (gonadotropins, androgens, and estrogens) believed to exert a profound influence on the testis and associated organs are considered, in order, and a careful resume of the proved clinical and experimental effects of their commercially available forms is furnished. The bibliography includes references to key articles relative to the development of this important division of endocrinology and, for such a brief text, the index is unusually complete.—Capt. S. Johnson, MC, U. S. N.

## BOOK REVIEW

*Diseases of the Ear, Nose, and Throat, A Textbook of Clinical and Laboratory Procedures*, by Georges Portmann, M. D., Professor of Otorhinolaryngology at the University of Bordeaux, Dean of the School of Medicine and Pharmacy of the University of Bordeaux, Surgeon at the Hospital of Tondu, Bordeaux, Surgeon at the Hospital Leopold Bellan, Paris. Translated by Fernand Montreuil, M. D., and Jules C. Walner, M. D., College of Physicians and Surgeons, Columbia University (New York). 728 pages, illustrated. The Williams & Wilkins Co., Baltimore, Md., publisher, 1951. Price \$20.

Dr. Portmann is well known in this country as a leading French otolaryngologist and has taught here as a visiting lecturer. This book is based on his method of teaching students in this clinical specialty. Each organ is considered, first in its normal condition, then in pathologic conditions. The basic structure and functions are briefly discussed, then methods for diagnosis are presented in great detail. The author lays great stress on history taking. The customary methods of diagnosis and special procedures of functional evaluation are described. Much of the equipment described is French and little used in this country, but the physician may easily read in his own chosen or available instruments. Great stress is laid on refined and elaborate techniques of vestibular studies, the one large area that American readers may find hard to accept. It is noted with pleasure that the really fine plates of temporal basic sections the author has exhibited here before are included in the discussion of the ear. This work is only on structure, function, and diagnosis and will be a useful reference for detailed and obscure tests to the specialist, but does not offer the simple and broad picture required by the casual worker in this field.

—*Capt. J. F. Lett, U. S. A. F. (MC)*

# The Use of Cortisone and ACTH in Treating Reactions to Penicillin<sup>(1)</sup>

Nestor M. Hensler, Captain, U. S. A. F. (MC)

Otto A. Wurl, Lieutenant Colonel, MC, U. S. A.

James O. Gillespie, Brigadier General, MC, U. S. A.

ALTHOUGH penicillin is considered a relatively innocuous agent, reactions following its administration are not uncommon. The delayed, or serum-sickness, type of sensitivity reaction is particularly distressing. Gilman (2) emphasized the increasing incidence and severity of such reactions and made a plea for more judicious use of penicillin. Although the exact incidence of such reactions is unknown, estimates vary from less than 1 percent (3) to 6 percent (4). One of us (NMH) recently noted an incidence of 4.5 percent delayed reactions in 138 patients receiving single injections of penicillin. When the frequency with which penicillin is used today is considered it is evident that such reactions must be responsible for a great amount of morbidity. Unfortunately, there is no reliable means of predicting who will react unfavorably to the drug (5,6). Treatment with epinephrine and antihistaminic drugs is often only partially successful in alleviating the severe itching, arthritic and myalgic pain, restlessness, and malaise which characterize the disease.

The effectiveness of ACTH and cortisone in relieving the symptoms of rheumatoid arthritis and rheumatic fever suggested the use of these agents in the treatment of a variety of allergic states. Included in the

(1) Letterman Army Hospital, San Francisco, Calif.

(2) Gilman, R. L.: Penicillin, an allergic hazard. U. S. Armed Forces M. J. 1: 1155-1156, Oct. 1950.

(3) Gordon, E. J.: Delayed serum sickness reaction to penicillin. J. A. M. A. 131: 727-730, June 29, 1946.

(4) Rouse, J. W. H.: Prevention and treatment of severe penicillin therapy and other drug reactions. South. M. J. 43: 195, 1950.

(5) Kolodny, M. H., and Denhoff, E.: Reactions in penicillin therapy. J. A. M. A. 130: 1058-1061, Apr. 20, 1946.

(6) Sherman, W. B.: Drug allergy. Am. J. Med. 3: 586-600, Nov. 1947.

reports on this subject are a small number of severe reactions to penicillin so treated with satisfactory and sometimes dramatic effect (7-10). These encouraging results have prompted the use of ACTH or cortisone in the treatment of 8 patients with severe reactions to penicillin in this hospital. Table I summarizes the clinical results in these patients.

### CASF REPORTS

**Case 1.** A 30-year-old man was admitted to this hospital on 21 January 1951 following an accident in which he incurred multiple lacerations and abrasions. Treatment included 200,000 units of aqueous penicillin twice daily beginning on 21 January. On 11 February he developed an urticarial rash with pruritus, and penicillin was discontinued. The urticaria became increasingly severe over a 2-week period in spite of an antihistaminic drug and epinephrine. In addition, severe asthralgia and joint swelling developed. On 28 February, the patient began complaining of difficulty in breathing and swallowing. He was acutely ill, restless, and irritable. There were multiple huge discrete and confluent urticarial lesions over the buttocks and shoulders. His temperature was 98° F.; his pulse was 144; and his blood pressure was 90/65. Symptomatic therapy was discontinued and 25 mg. of ACTH was given every 6 hours. Within 6 hours the patient was subjectively improved and within 12 hours his difficulty in respiration and swallowing was definitely decreased, his pruritus and joint pain were less severe, and his urticaria had decreased by 50 percent. His skin lesions had entirely disappeared within 3 days. His pruritus and joint pain diminished more gradually over a 10-day period. On 9 March ACTH was discontinued after 560 mg. had been given. Within 48 hours the urticarial lesions reappeared and the patient complained of increasing pain in the joints. On 12 March, therefore, treatment with 25 mg. of cortisone intramuscularly every 6 hours was begun. Again, within 3 days the skin lesions disappeared. In 7 days he was asymptomatic except for moderate pruritis and slight back pain. The cortisone was discontinued on 26 March, after 1200 mg. had been given, and an antihistaminic drug was given to control the pruritus. He remained relatively asymptomatic, though he continued to have small areas of transient urticaria every second or third day up to the time of discharge from the hospital on 12 April.

(7) Carey, R. A., Harvey, A. M., Howard, J. E., and Tapley, P. F.: Effect of adrenocorticotrophic hormone (ACTH) and cortisone on drug hypersensitivity reactions. *Pell-Johns Hopkins Hosp.* 27: 334-346, Nov. 1950.

(8) Howard, J. E., Harvey, A. M., Carey, R. A., and Viskeawerder, V. L.: Effects of pituitary adrenocorticotrophic hormone (ACTH) on hypersensitive state. *J. A. M. A.* 144: 1347-1349, Dec. 16, 1950.

(9) Boedley, J. L., Harvey, A. M., Howard, J. E., and Newens, E. S.: Preliminary report on use of ACTH in hypersensitive state. In More, J. R. (editor): *Proceedings of the First Clinical ACTH Conference*. Blakiston Co., Philadelphia, Pa., 1950, p. 47.

(10) Feinberg, S. M., Desaeger, T. B., and Mankel, S.: ACTH and cortisone in allergic manifestations, therapeutic results and studies on immunological and tissue activity. *J. Allergy* 22: 195-210, Mar. 1951.

*Comment.* This patient had a severe reaction to penicillin which became worse under symptomatic therapy. The response to ACTH was dramatic, but symptoms recurred within 48 hours after discontinuing this drug. A good symptomatic response was then obtained with cortisone, though this response was less prompt and less complete than that following ACTH. Persistent urticaria indicates that the hypersensitive state still existed at time of discharge from the hospital.

*Case 3.* A 38-year-old woman was admitted to the hospital on 23 March 1951 for treatment of chronic pelvic inflammatory disease. She was given 300,000 units procaine penicillin daily beginning on the day of admission. On 28 March a laparotomy was performed and penicillin therapy was continued postoperatively until 3 April. On 4 April she developed urticaria on her legs and trunk with severe pruritus. The urticaria spread rapidly in spite of an antihistaminic drug and marked edema of her legs and face developed. On 6 April effusion of her wrist and knee joints was noted and she was extremely uncomfortable because of pruritus. On 7 April treatment with 100 mg. of cortisone every 8 hours was started. After 3 doses it was given in progressively diminishing doses. Within 24 hours the edema and pruritus had almost disappeared and there was marked regression of the urticarial lesions. At the end of 2 days of therapy she was asymptomatic except for mild joint pains. Cortisone was discontinued on 11 April after 600 mg. had been given. Fifteen days later she had a recurrence of urticaria which subsided spontaneously in several days. There were no joint symptoms or other systemic manifestations at this time. Three months later there had been no recurrence.

*Case 5.* On about 26 April 1951, a 27-year-old man received an injection of aqueous penicillin because of an infection in a tooth. About 6 hours later he noted soreness of his throat and tongue which subsided after a few hours. He was thereafter asymptomatic until 5 May when he noted swelling and itching of the right foot. Within 24 hours marked edema of his hands, feet, and face and a generalized rash developed. His only previous exposure to penicillin was about 2 months previously when he had taken several penicillin troches. Following this his tongue became sensitive and his throat was sore for a short period. About 5 years previously he had had an episode of generalized urticaria following an insect bite. On admission to this hospital on 6 May his temperature was 100° F. and his pulse was 80. There was marked edema of his feet, hands, lips, and periorbital regions. There were numerous urticarial wheals over most portions of his body, especially over his extremities, forehead, and scalp (fig. 1).

In spite of vigorous treatment with an antihistaminic drug, epinephrine, and intravenous procaine, his symptoms increased in severity. His pruritus was intense; his urticaria spread rapidly; and his edema increased. It was necessary to cut a ring to prevent gangrene of one of his fingers. His temperature rose to 103° F. On 7 May, symptomatic therapy

TABLE I. Summary of 8 cases of severe reactions

Case	Age (years)	Sex	Clinical manifestations	Duration of symptoms (days)	Response to therapy	
					Clinical improvement (hours)	Complete relief (days)
1	30	Male	Urticaria, arthritis, dysphagia, difficult breathing	18	6	10
2	29	Male	Fever, urticaria, arthri- tis, nausea, severe pruritus	3	Recurrence	18
3	32	Female	Urticaria, edema, ar- thritis with joint effusion	3	24	4
4	36	Male	Persistent urticaria and pruritus after subsidence of ar- thritis and fever on symptomatic therapy	14	72	6
5	27	Male	Fever, lethargy, urti- caria, angioneurotic edema, severe pru- ritus	2	Recurrence	Unknown
6	20	Male	Fever, lethargy, nausea, vomiting, urticaria, angioneurotic edema, dysphagia	2	30	5
7	40	Male	Chills, fever, sore throat, arthritis, my- algia, urticaria, bul- lous, scleropathy	5	5	3
					Recurrence	12
					Recurrence	5
					Recurrence	5
8	41	Male	Chills, fever, sore throat, urticaria, arthri- tis, edema, sclerop- athy	4	15	2

\* All patients were white.

† Intra-muscular.

‡ Intra-venous.

*to penicillin treated with cortisone or ACTH\**

Duration of treatment (days)	Total dosage		Route of administration	Relapse	
	ACTH (mg.)	Cortisone (mg.)		Days after discontinuing treatment	Symptoms
9	560		IM	2	All previous symptoms.
11		1200	IM		
8		500	IM		Residual urticaria.
5		600	IM	15	Transient urticaria. No further treatment needed.
7		650	IM (2 days) Oral (5 days)	9	All previous symptoms.
7		350	Oral		
10		1050	Oral		No further recurrence.
7		800	Oral		*
7		775	IM	2	All previous symptoms.
12		1250	IM	2	All previous symptoms.
4	100		IV	3	Urticaria. Recurrence of all previous symptoms on sixth day.
3	50		IV	6	Urticaria. Responded dramatically to I. V. ACTH on 3 occasions during next 2 weeks. No response to antihistaminic drugs or I. V. placebo. Asymptomatic 5 days at time of writing.
4		450	IM		

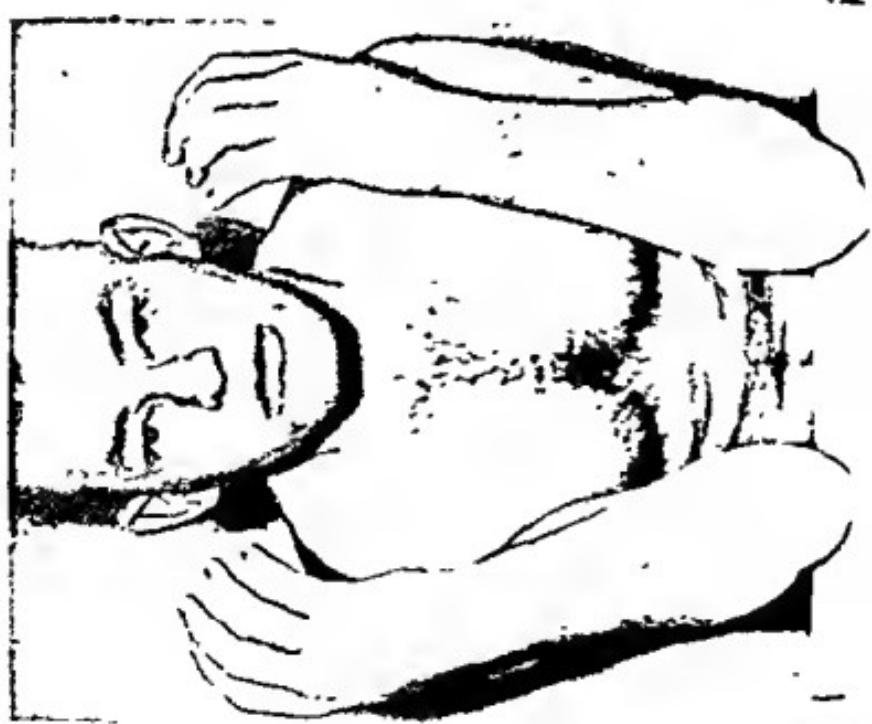
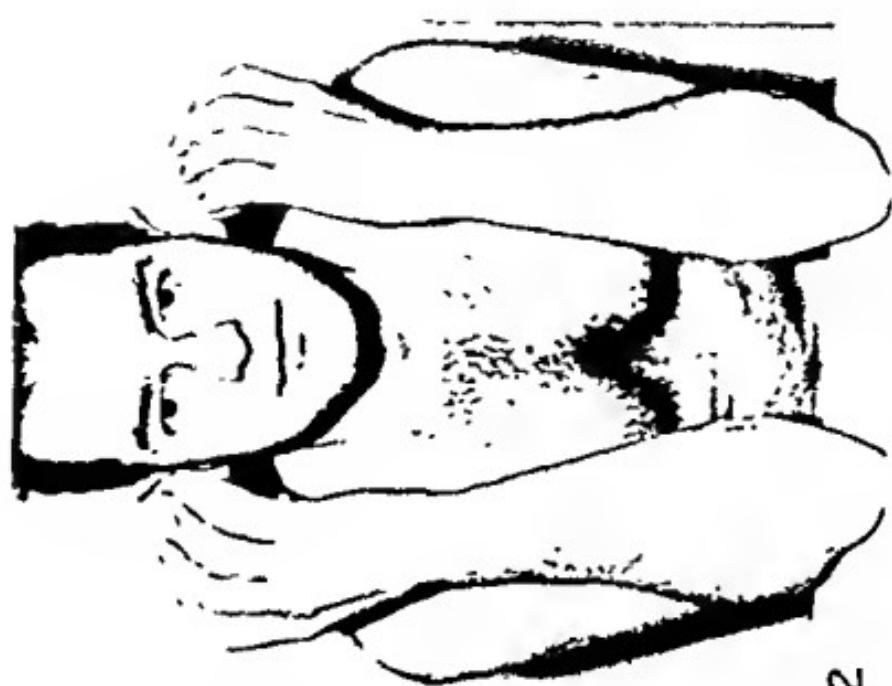


Figure 1 (case 3). Appearance of patient on 7 May 1951. Note marked edema of hands and face, particularly on arms, fingers, and face.  
(Cirrhosis was absent 2 hours later.) Figure 2 (case 3). Appearance of patient on 11 May 1951. (Same and anterio-posterior view unchanged.)

was discontinued and treatment with 50 mg. of cortisone every 6 hours was started. After 2 days the dose was reduced to 25 mg. every 6 hours. His symptoms continued to become more severe for about 10 hours after the institution of cortisone therapy. His lips and eyes became markedly swollen; urticarial lesions covered 70 percent of his body; and he became lethargic. His temperature continued to be between 102° and 103° F. Eight hours later he began to feel better; his edema and urticaria decreased; and his temperature fell to 100° F. By 9 May his edema and urticaria had subsided completely and he was afebrile (fig. 2). His only complaint was mild pruritus. During the next 4 days he had transient localized urticaria. Cortisone was discontinued on 16 May after 1050 mg. had been given. There was no recurrence in the 9 weeks which followed.

**Comment.** These cases of reaction to penicillin responded promptly to cortisone therapy. In contrast to case 1, there was no recurrence, or minimal recurrence, of symptoms, and no further therapy was required. Cases 2, 6, and 8 responded similarly as shown in table 1.

#### DISCUSSION

The mechanism whereby cortisone and ACTH modify the allergic process is not known. Sprague (11) has summarized the available data on this subject and the various experimental and clinical studies reported will not be recounted here. The evidence indicates that neither circulating antibodies nor skin sensitivity are uniformly altered by these hormones, nor do they seem to act as antihistaminic agents. They apparently act at a tissue level, providing the "susceptible tissues with a shieldlike buffer against the irritant" (12). That they do exert a profound effect on the hypersensitive state is evident from the results noted in these and other cases reported. This effect is illustrated by the 3 patients who responded favorably only to relapse from 2 to 9 days after treatment was discontinued. In all patients resumption of therapy with either ACTH or cortisone resulted in prompt subsidence of symptoms. These cases add further weight to the already overwhelming evidence that ACTH and cortisone merely suppress the manifestations of hypersensitivity without altering the hypersensitive state.

Examination of table 1 might leave the impression that early treatment decreases the chance of recurrence because those patients requiring more than one course of treatment had symptoms for 5 or more days prior to treatment, whereas those without recurrence or with minimal recurrence were treated within 4 days of onset of symptoms. No conclusion can, however, be drawn from such a small series. Although these reactions to penicillin usually run a course of from 7 to 10 days, it is not unusual for symptoms to persist for 30 or more days. It is most

(11) Sprague, R. G.: Cortisone and ACTH; review of certain physiologic effects and their clinical implications. *Am. J. Med.* 10: 567-594, May 1951.

(12) Hench, P. S.: Introduction: cortisone and ACTH in clinical medicine. *Proc. Staff Meet., Mayo Clin.* 25: 474-476, Aug. 16, 1950.

likely that the patients who relapsed were destined to chronicity from the onset; therefore, the course of treatment merely failed to encompass the period of hypersensitivity.

All who were concerned with these patients were impressed with the prompt and often dramatic results. Although the routine use of cortisone and ACTH is not recommended for such self-limited and usually benign conditions as reactions to penicillin, these agents may be extremely valuable in patients with (1) severe reactions with high fever, shock, severe arthralgia, or laryngeal or pharyngeal edema; (2) less severe syndromes not responding to symptomatic therapy (13); and (3) reactions which constitute a dangerous complication of an already existing disease (14).

### CONCLUSIONS

Treatment with ACTH and cortisone in 8 patients with reactions to penicillin gave favorable results in all instances, although recurrences of symptoms following withdrawal of the drug were not uncommon.

(13) Cases 1 through 7 fall in these two categories.

(14) Case 8 is an example of this. The patient's right foot and ankle were encased in a plaster cast following an arthrodesis a few days previously. In addition to pruritis, urticaria, and fever, edema of the hands and face was evident when cortisone therapy was started. Edema of the feet might have jeopardized the success of his operation. His edema subsided promptly following treatment with cortisone.

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# Observations on Essentially Normal Young Men Treated With ACTH and Cortisone<sup>(1, 2)</sup>

## I. EFFECTS ON GLUCOSE METABOLISM

Saul B. Appel, Major, MC, U. S. A.

Kenneth D. Orr, Lieutenant Colonel, MC, U. S. A.

**H**YPERGLYCEMIA and glycosuria resulting from alterations in carbohydrate metabolism during therapy with ACTH and cortisone have been readily produced in animals (3). Although in the past few years these hormones have been used widely in the treatment of numerous diseases, severe manifestations of glucose intolerance have not been a common or uncontrollable complication.

In 9 of 10 normal human beings treated with 50 to 100 mg. of ACTH daily, hypoglycemia and diabetic glucose tolerance curves began to appear 24 hours after the onset of therapy (3). All patients manifested glycosuria of from 2 to 50 grams daily. The glucose intolerance demonstrated in these normal subjects was attributed to differences in individual end-organ responses (enzymatic effects on insulin production and/or resistance to insulin) (4). The possibility that glucose intolerance during therapy with ACTH and cortisone represents a predisposition to diabetes mellitus or latent diabetes mellitus (5,6) would not explain the frequency with which it was detected in normal persons.

(1) From the Cold Injury Section, Osaka Army Hospital.

(2) The first of three articles on this subject. The statistical analyses were made by H. M. C. Luykx, D. Sc.

(3) Conn, J. W.: Effects of ACTH on carbohydrate metabolism in normal human beings. In Mote, J. R. (editor): Proceedings of the First Clinical ACTH Conference. The Blakiston Co., Philadelphia, Pa., 1950, pp. 86-107.

(4) Conn, J. W.: ACTH diabetes in man, end-organ response versus adrenocortical response. (Abstract) J. Clin. Endocrinol. 10: 825, July 1950.

(5) Sprague, R. G.; Power, M. H.; Mason, H. L.; Albert, A.; Mathieson, D. R.; Hench, P. S.; Kendall, E. C.; Slocumb, C. H.; and Polley, H. F.: Observations on physiologic effects of cortisone and ACTH in man. Arch. Int. Med. 85: 199-258, Feb. 1950.

(6) Thors, G. W.; Forsham, P. H.; Frawley, T. F.; Hill, S. R., Jr.; Roche, M.; Staehelin, D., and Tilson, D. L.: Clinical usefulness of ACTH and cortisone. New England J. Med. 242: 783-792, May 18, 1950.

Renal glycosuria has been described after ACTH therapy (7) and this might explain glycosuria to some extent but not a diabetic type of glucose tolerance curve. Some observers have noted an increase in the fasting blood glucose (3,6) and others have found no statistically significant increase (5) even after giving ACTH intravenously (8).

During our study of the effects of ACTH and cortisone on the healing of frostbite lesions, an opportunity was afforded for evaluating the changes in glucose metabolism in a large group of essentially normal young men.

#### METHODS

The subjects, including the controls, were men with varying degrees of frostbite lesions of either the toes, fingers, or heels. Only one subject (ACTH 56) had severe fourth degree frostbite of both feet necessitating amputation and therapy was discontinued after 12 days because of complicating side effects.

The ACTH group consisted of 14, the cortisone group of 22, and the control group of 23 subjects (9). The mean ages were 22.8, 22.2, and 21.1, respectively. The differences are insignificant. In establishing the glucose tolerance pattern of the control group, 10 additional frostbite patients with comparable lesions were selected at random and tested.

TABLE I. Time of admission and treatment as related to onset of frostbite

Group	Number	Mean number of days between onset of frostbite and	
		Admission	Hormone therapy
ACTH	11	14.5 ± 3.5*	25.1 ± 5.6*
Cortisone	16	14.4 ± 1.5	31.3 ± 3.4
Control	23	25.1 ± 3.7	38.4 ± 3.2

\*Standard error

Table I shows the time of admission and treatment relative to the onset of frostbite as determined from the clinical history. The critical ratio comparing the differences in the standard error of the means for the control and cortisone group (admission day after frostbite) is 2.7 ( $P \approx 0.007$ ). The glucose tolerance tests were not done until well after hormone therapy was started and there was no significant difference between the groups at this time. The subjects had been exposed for

(7) Baum, J. J. - Clinical effects of cortisone and ACTH on rheumatic diseases. Bull New York Acad Med 27: 75-100, Feb 1951.

(8) Sayres, G., Buza, T. V., Tyler, F. H., Jager, B. V., Schwartz, T. B.; Smith, E. L., Samuels, L. T., and Davenport, H. W. Metabolic actions and fate of intravenously administered adrenocorticotropic hormone in man. J Clin Endocrinol 9: 593-614, July 1949.

(9) A few of these who developed toxic symptoms did not receive the full course of hormonal treatment and were not included in the final tabulation.

varying periods of time to combat, fatigue, and lack of various edible delicacies. Their appetites for soft drinks and candy were often ravenous and persisted throughout the period of observation; cortisone 30 prided himself on consuming 24 chocolate bars daily. All subjects were on an unlimited dietary intake except for 2 in the cortisone group (59,60) and 2 in the ACTH group (57,58) whose fluid intake was reduced; they were allowed only 2 bottles of soft drink and 1 candy bar daily. Only 1 subject (cortisone 59) presented a familial history of diabetes mellitus, and his glucose tolerance tests on the fifteenth and twenty-fourth days of therapy were normal. Three control subjects had similar familial histories, 2 demonstrating normal tolerance and 1 a 2-hour level greater than his fasting level.

Twenty mg. of ACTH was administered intravenously in 1 liter of 5 percent dextrose in water or saline solution except when the infusion was coupled with a glucose tolerance test, at which time the infusion was normal saline solution without dextrose. The infusion lasted about 6 hours and was maintained for 31 consecutive days. Therapy had been established for 9 days prior to the beginning of this study. Cortisone was given orally as follows: 400 mg. (100 mg. every 6 hours) for 1 day; 300 mg. (75 mg. every 6 hours) on the second day, 200 mg. daily (50 mg. every 6 hours) until the twelfth day at which time 200 mg. (100 mg. at 0800 and at 2000) was given daily through the thirty-first day.

When glucose tolerance tests were performed 100 gm. of dextrose were dissolved in about 240 ml. of chilled lemonade, to which was added 30 ml. of medicinal whisky to increase palatability and cooperation of the subjects. About 4 ml. of blood was drawn and mixed with a dehydrated preparation of sodium fluoride and potassium oxalate, prepared routinely in the laboratory in special screw-topped vials. Specimens were drawn at 0 (fasting),  $\frac{1}{2}$ , 1, 2, and 3 hours. With the cooperation of the nursing staff it was possible to perform from 10 to 13 tests simultaneously with negligible errors in timing. The subjects voided prior to the ingestion of the mixture. Subsequent urine was collected until the last venipuncture. This urine was tested by the Benedict qualitative test for glucose. The blood sugar concentration was determined by the Folin and Wu method.

A modified Thorn eosinophil test (10) was made on all subjects. These tests were performed by the same technician throughout this study. The stock staining and diluting solution consisted of 2 grams of eosin in 100 ml. of 95 percent alcohol which was refrigerated. The test solution consisted of 5 ml. of stock solution, 5 ml. of acetone and 90 ml. of distilled water. It was refrigerated and renewed every 7 days. Prior to the intravenous administration of ACTH (20 mg. in 1 liter of normal saline solution) venous blood was drawn and mixed for 30

(10) Thorn, G. W.; Forsham, P. H.; Prunty, F. T. G.; and Hills, A. G.: Test for adrenal cortical insufficiency: response to pituitary adrenocorticotropic hormone. J. A. M. A. 137: 1005-1009, July 17, 1948.

TABLE 2 Glucose tolerance tests: ACTH subjects

Day of therapy	Procedure	Mean mg. per 100 ml. s.t.			
		Fasting	1/2 hr.	1 hr.	2 hr.
18-19	Routine test with dextrose orally	69.5 ± 2.00*	104.0 ± 3.67*	96.2 ± 8.32*	80.1 ± 5.73*
	Intravenous infusion of ACTH for 2 hours with dextrose orally	88.4 ± 2.18	111.6 ± 4.30	117.4 ± 6.36	103.2 ± 6.28
	Intravenous infusion of ACTH for 2 hours with no dextrose	77.2 ± 3.38	78.6 ± 3.99	82.8 ± 3.37	84.4 ± 3.67
Days after therapy		79.4 ± 4.09	92.6 ± 7.99	92.9 ± 7.74	77.5 ± 6.59
17	Routine test with dextrose orally	77.0 ± 2.45	105.0 ± 7.16	101.0 ± 7.92	74.5 ± 4.59
	Routine test with dextrose orally				71.0 ± 1.16

\*Standard error

seconds in tubes containing desiccated ammonium potassium oxalate. Blood was drawn up to the 1.0 mark, the pipette was filled with test solution and shaken by hand for about 3 minutes. Both chambers of a standard Nebauer ruled hemocytometer were charged. The sum of the eosinophils of the entire ruled area in both chambers was obtained and multiplied by 11.1 to give the number of eosinophils per cu. mm. Eosinophil counts were made at 0 and 5 hours after starting the ACTH infusion which ran rapidly and was completed in from 1 to 2 hours.

### RESULTS: ACTH GROUP

Table 2 shows the mean values with their standard error of the serial glucose tolerance tests. In figure 1 curves 6, 7, 8, 9 represent the means. The number of observations ranged from 11 to 13 except on the twenty-fourth day after treatment when 4 subjects who had previously demonstrated abnormal results were studied. Comparing these results with the control group means  $\pm$  2 S. E. (table 3) the following conclusions may be drawn:

1. On the eighteenth day of therapy only the fasting specimen is significantly lower in the treated group.
2. On the twentieth day of therapy the fasting specimen is significantly elevated. We cannot account for this rise as compared to results on the 2 previous days in the same group of subjects.
3. The results at 1, 2, and 3 hours on the twentieth day indicate that the ACTH infusion prevented the blood glucose from falling to the fasting levels.

TABLE 3. Glucose tolerance tests: Control subjects

Mean mg. per 100 ml. at:				
Fasting	1/2 hr.	1 hr.	2 hr.	3 hr.
80.7 $\pm$ 1.47*	105.5 $\pm$ 3.03*	95.9 $\pm$ 3.63*	80.9 $\pm$ 2.41*	71.0 $\pm$ 1.81*

\*Standard error.

No subject had glycosuria during this procedure. On the twenty-seventh day of therapy the ACTH infusion was administered without giving glucose to evaluate the effect on the fasting blood glucose. When the standard errors of the means of the 1, 2, and 3 hour specimens are compared with that of the fasting specimen there appears to be no significant difference, but if the individual increments during the procedure are analyzed (table 4) 8 of 13 subjects (except 4, 8, 9, 57, and 58) showed a definite gradual rise. Unfortunately, these subjects were not tested in the fasting state without an infusion of ACTH, but if we compare the mean of the increment for each time interval with its standard error (assuming that there would be negligible changes in the fasting blood glucose level without the ACTH infusion over a 3-hour period) we

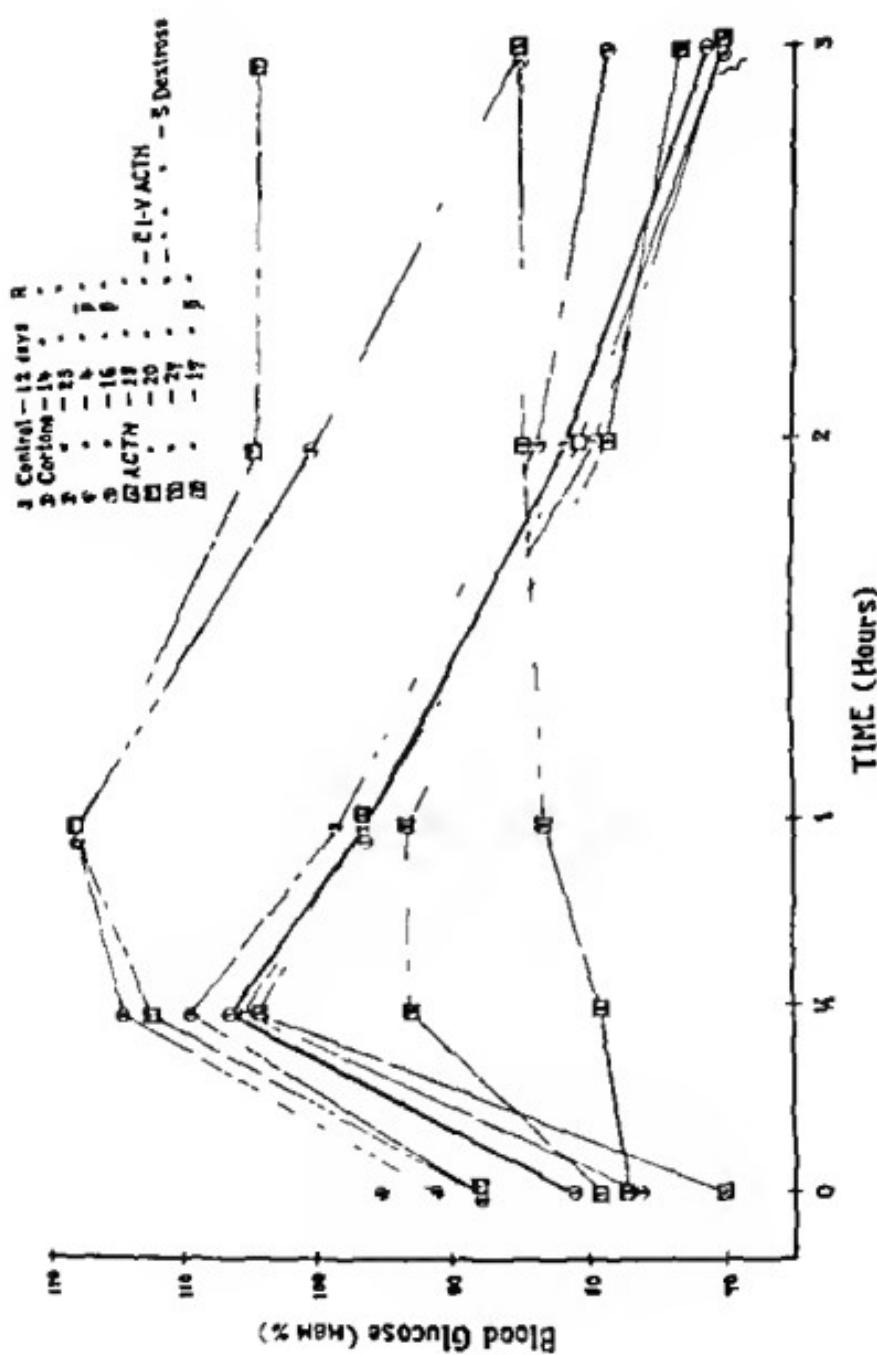


Figure 1. Glucose tolerance tests.

find the following critical ratios: (1) at  $\frac{1}{2}$  hour, 0.52 ( $P = 0.38$ ) which is not significant; (2) at 1 hour, 2.12 ( $P = 0.036$ ) which is probably significant; (3) at 2 hours, 3.43 ( $P = 0.0007$ ) which is highly significant; and (4) at 3 hours, 2.67 ( $P = 0.008$ ) which is highly significant. Thus, intravenous infusion of ACTH in fasting subjects produced a rise in 8 of 13, or a general significant rise 1, 2, and 3 hours after starting the infusion. Some previous observers (5, 6) noted no significant change while others (3, 6) have described an increase in fasting blood sugar during therapy. Seventeen days after therapy the glucose tolerance curves were within normal limits. The curves of 4 subjects were abnormal; 2 were flat and 2 were elevated at 2 hours. These were all normal 1 week later. Simultaneous administration of ACTH intravenously and glucose orally elevated the 1-hour level and obliterated the 2- and 3-hour fall.

TABLE 4. Change in fasting blood glucose (in mg. per 100 ml.) during intravenous infusion of ACTH

Subject	Time (hours)									
	0		1/2		1		2		3	
	Absolute	Absolute	Net	Absolute	Net	Absolute	Net	Absolute	Net	
1	98	104	+ 6	92	-6	102	+ 4	110	+ 12	
2	87	107	+ 20	106	+ 19	112	+ 25	106	+ 19	
3	70	87	+ 17	85	+ 15	82	+ 12	83	+ 13	
4	76	73	- 3	75	- 1	77	+ 1	79	+ 3	
5	72	72	—	85	+ 13	82	+ 10	71	- 1	
6	61	70	+ 9	71	+ 10	78	+ 17	65	+ 4	
7	77	77	—	93	+ 16	93	+ 16	89	+ 12	
8	96	87	- 9	96	—	101	+ 5	104	+ 8	
9	83	71	- 12	73	- 10	73	- 10	73	- 10	
10	61	61	—	73	+ 12	73	+ 12	75	+ 14	
11	68	70	+ 2	73	+ 5	78	+ 10	80	+ 12	
57	68	62	- 6	65	- 3	73	+ 5	71	+ 3	
58	87	81	- 6	89	+ 2	73	- 14	81	- 6	
Mean net change	+ 1.38		+ 5.54		+ 7.15		+ 6.38			
Standard error	2.64		2.61		2.09		2.39			

### RESULTS: CORTISONE GROUP

Table 5 shows the means and standard errors for the cortisone group. In figure 1 curves 2, 3, 5 and point 4 represent the means. On the ninth through twelfth days of therapy there was no significant difference as compared with the control group. On the twenty-fifth and twenty-sixth days of therapy there was a significant elevation of the fasting blood glucose level and the tolerance test was significantly elevated at 1, 2,

TABLE 5. Glucose tolerance tests: cortisone subjects

Day of therapy	Mean mg. per 100 ml. at:				
	Fasting	1/2 hr.	1 hr.	2 hr.	3 hr.
9-12	73.5 ± 2.03*	104.7 ± 3.41*	96.2 ± 4.67*	79.2 ± 3.93*	70.3 ± 2.42*
25-26	90.5 ± 1.81	113.5 ± 4.34	116.8 ± 3.91	98.5 ± 6.57	83.5 ± 2.50
Days after therapy					
4	94.6 ± 2.09	-	-	-	-
15-16	87.9 ± 11.12	109.1 ± 8.04	98.4 ± 17.45	83.2 ± 16.37	77.6 ± 11.27
24	82.7 ± 1.69	111.3 ± 3.79	112.4 ± 10.42	88.6 ± 11.37	76.4 ± 4.93

\*Standard error

and 3 hours. Point 4 in figure 1 represents the fasting blood glucose 4 days after therapy,  $94.6 \pm 2.09$ . Comparing the difference in the standard error of the mean with that of the control group,  $80.7 \pm 1.47$ , the critical ratio is 5.5, and P is less than 0.0000006 or highly significant.

#### ABNORMAL GLUCOSE TOLERANCE TESTS

Glucose intolerance was interpreted as either any blood glucose value during a tolerance test outside the range of 2 standard deviations of the control group or a higher blood glucose value at 2 hours than at

TABLE 6. Abnormal glucose tolerance tests: ACTH group

Subject	Day of therapy	Mg. of glucose per 100 ml. at:				
		Fasting	1/2 hr.	1 hr.	2 hr.	3 hr.
57	2	71	85	105	110	62
2	18	69	141	150	102	76
8	18	78	96	152	127	95
9	18	70	101	96	78	62
	Days after therapy					
2	17	86	107	111	118	68
9	17	111	120	125	111	97

TABLE 7. *Abnormal glucose tolerance tests: cortisone group*

Subject	Day of therapy	Mg. of glucose per 100 ml. at:				
		Fasting	1/2 hr.	1 hr.	2 hr.	3 hr.
15	14	79	123	136	133	73
18	14	74	87	149	70	84
20	14	72	98	68	83	83
25	14	79	115	87	94	78
31	14	67	126	124	94	54
12	25	71	92	89	78	78
14	25	104	117	121	95	93
15	25	97	122	158	175	97
17	25	94	113	121	111	91
18	25	79	140	132	128	61
19	25	90	117	107	104	82
20	25	100	104	107	100	93
24	25	82	86	96	91	80
25	25	85	104	202	83	70
30	25	96	104	132	128	84
31	25	102	154	200	159	104
	Days after therapy					
15	4	125	—	—	—	—
20	4	102	—	—	—	—
22	4	100	—	—	—	—
30	4	100	—	—	—	—
31	4	108	—	—	—	—
12	16	74	108	87	96	74
15	16	92	133	158	150	107
16	16	115	108	105	100	104
17	16	78	114	90	82	85
18	16	137	148	126	85	73
20	16	83	124	84	93	66
21	16	104	134	104	72	94
22	16	100	120	115	80	78
31	16	75	104	127	104	108
14	24	85	123	96	93	77
15	24	85	100	158	139	102
31	24	83	119	133	119	65

the time of starting the test. In the ACTH group, 2 subjects were tested on the second and fourth day of therapy, the former (57) exhibiting glucose intolerance. On the eighteenth day of therapy, 3 of 13 and on the seventeenth day *after* therapy 2 of 11 subjects showed glucose intolerance (table 6). In the cortisone group on the fourteenth day of therapy, 5 of 20 and on the twenty-fifth day of therapy 11 of 20 subjects showed glucose intolerance. On the fourth day *after* therapy, 5 of 20 subjects demonstrated an elevated fasting blood glucose, and on the sixteenth day *after* therapy 9 of 20 subjects showed glucose intolerance. On the twenty-fourth day *after* therapy 7 of the subjects (14, 15, 16, 18, 21, 22, and 31) who had abnormal tests 8 days previously were tested, 3 of them still showed glucose intolerance (table 7). Two subjects (cortisone 25, 31) had a blood glucose level of 202 and 200 mg. per 100 ml. respectively, at 1 hour. The former may have been an error because of the otherwise relatively normal values recorded. Glycosuria was not observed in any of the subjects during the glucose tolerance tests.

TABLE 8. Eosinophil test ACTH subjects\*

Day		Number	Eosinopenia over 50 percent		Mean change (percent)
of therapy	after therapy		Number	(percent)	
27		13	12	92**	-87 ± 4.9***
	10	11	8	73	-63 ± 6.9
	12	4	3	75	-66 ± 13.6

\*20 mg. of ACTH in 1,000 ml. of normal saline solution was given intravenously as rapidly as possible (in from 1 to 2 hr.).

\*\*The cumulative eosinopenia indicates the total number of subjects in a group tested serially who showed a significant response to the eosinophil test, i. e., a fall in circulating eosinophils of 50 percent or more 3 hours after the onset of an intravenous infusion of 20 mg. of ACTH in 1 liter of normal saline solution.

\*\*\*Standard error.

#### RELATIONSHIP OF GLUCOSE INTOLERANCE TO EOSINOPHIL RESPONSE

The ACTH group showed normal eosinophil responses with a few exceptions on the twenty-seventh day of therapy and on the tenth day *after* therapy (table 8). Subject 57 showed an elevated 2-hour blood glucose level on the second day of therapy, a drop of 41 percent in eosinophils on the tenth day of therapy, a normal glucose tolerance test on the eighteenth day of therapy, and a drop of 100 percent in eosinophils on the twenty-fourth day of therapy. The 3 subjects with drops less than 50 percent (41 percent in subject 1, 30 percent in subject 7, and 46 percent in subject 11) on the twelfth day *after* therapy showed normal glucose tolerance throughout.

TABLE 9. Eosinophil tests: cortisone subjects (1)

Day after therapy	Number tested	Eosinopenia over 50 percent		Mean change (percent)
		Number	Percent	
3	20	4	20	-5 ± 15.6 <sup>(2)</sup>
10	19	7	37	+15 ± 20.9
12	15	7	47	-23 ± 19.2
17	9	4	44	-36 ± 12.5
17	11 <sup>(4)</sup>	1	9	+9 ± 12.5
19	20 <sup>(5)</sup>	9	45	-41 ± 6.3
19 <sup>(7)</sup>	10	7	70	-50 ± 13.7
23	7	3	43 <sup>(6)</sup>	-51 ± 12.8

(1) 20 mg. of ACTH to 1,000 ml. of normal saline solution was given intravenously as rapidly as possible (in from 1 to 2 hr.).

(2) Standard error.

(3) The cumulative eosinopenia was  $\frac{17}{20}$  or 60 percent.

(4) Control subjects to whom an infusion of saline solution without ACTH was injected.

(5) 100 mg. of cortisone was given by mouth instead of the ACTH.

(6) The cumulative eosinopenia was  $\frac{15}{19}$  or 79 percent.

(7) Control subjects tested with 100 mg. of cortisone by mouth 4 hours before test and no infusion.

Table 9 shows the results of the eosinophil tests in the cortisone group. The refractorness of the adrenal cortex after cessation of therapy is evident as long as 17 and 23 days after therapy. It appears that disturbances in carbohydrate metabolism may persist even though the eosinophil response to ACTH returns to normal after cortisone therapy. In this group on the fourth day *after* therapy there were 5 abnormal fasting glucose levels (subjects 15, 20, 22, 30, and 31). Their eosinophil responses on the previous day were -34, -20, -64, -86, and -14 percent respectively. On the sixteenth day *after* therapy 9 subjects had abnormal glucose tolerance tests and their eosinophil responses are shown in table 10. Five of these subjects (15, 16, 18, 20, and 22) had normal responses. Thus, in 14 subjects with persisting glucose intolerance after therapy a normal eosinophil response was present in 7.

## DISCUSSION

The subjects studied demonstrated other side effects in addition to alterations in glucose tolerance. Hypertension and the development of a "moon face" appeared more frequently in the cortisone than in the ACTH group (11). This discrepancy may be related to the difference in method of administration of the drugs. Theoretically ACTH should

(11) Appel, S. B.; Fulton, L. A.; and Orr, K. D.: Observations on essentially normal young men treated with ACTH and cortisone. III. Side effects. To be published.

TABLE 10. Eosinophil tests of subjects in cortisone group with abnormal glucose tolerance tests on sixteenth day after therapy

Subject	Eosinophil response (percent change)		
	Day after therapy		
	10	12	17
12	+ 25	--	--
13	+ 20	-84	-61
15	- 50	-34	-69
17	+ 25	0	-14
18	- 50	-87	--
20	- 72	--	--
21	+114	-41	+ 8
22	- 59	--	--
31	--	+33	-37

be administered at a constant rate. In previous investigations (3, 5, 6) the drug was given in divided doses intramuscularly every 6 hours. The intravenous route potentiates the clinical effects approximately tenfold (12). In rats the ACTH level falls logarithmically, and the half time of disappearance is about 5.5 minutes (13). After intracardiac injection of iodinated ( $I^{131}$ ) ACTH in rats, Sonenberg et al. (14) demonstrated maximum concentration of radioactivity in the adrenal cortex immediately after administration. After 2 hours practically no radioactivity was detected (14, 15). Thus, we may assume that the subjects treated with a daily 6-hour intravenous infusion of ACTH experienced adrenal cortical stimulation for at least 8 hours but probably not much longer.

No instance of foreign protein reaction was observed during or following either the 6-hour or rapid (1- to 2-hour) ACTH infusion. There was no significant alteration in arterial blood pressure during the infusion (11). The fasting blood glucose rose during a 3-hour infusion.

No instance of clinical hypoglycemia (6) or other untoward effects were noted after the abrupt cessation of hormone therapy. Seventeen days after therapy 5 of 11 subjects in the ACTH group had flat glucose

(12) Talbot, J. H. Personal communication.

(13) Greenspan, F. S., Li, C. H., and Evans, H. M.: Disappearance rate of adrenocorticotrophic hormone from rat's plasma after intravenous injection. Endocrinology 45: 261-264, Mar. 1950.

(14) Sonenberg, M., Keston, A. S., and Mosley, W. L.: Studies with labelled anterior pituitary preparations, adrenocorticotropin. Endocrinology 48: 148-161, Feb. 1951.

(15) Keston, A. S. Personal communication.

tolerance curves, but the results for the entire group were not significantly altered. Two of these subjects were retested a week later and showed physiologic curves. Three of 20 subjects in the cortisone group showed slight flattening of the tolerance test on the sixteenth day after therapy.

The results indicate that mild glucose intolerance is common during therapy with ACTH and cortisone in essentially normal young men. Because of the limited data the earliest appearance of alterations in glucose metabolism was not determined. For the cortisone group as a whole, however, significant disparity from the control group was not observed on the fourteenth to seventeenth days of therapy but was noted on the twenty-fifth and twenty-sixth days. These alterations persisted in some subjects to the seventeenth and twenty-fourth days after therapy (cortisone 15 and 31).

The glucose tolerance test demonstrated abnormalities after the fasting blood glucose determinations, eosinophil tests and blood pressure records (11) returned to normal. A "diabetogenic response" to ACTH or cortisone therapy was elicited in most normal subjects in whom repeated glucose tolerance tests were performed. The frequency of a mild diabetogenic response suggests that it is related to dosage and duration of therapy rather than to a major difference in end-organ susceptibility (4). ACTH intravenously coupled with an oral glucose load demonstrated a significant alteration in glucose tolerance as suggested previously (8). A direct pharmacologic action is likely, and individual variability rather than susceptibility probably determines the magnitude of the alteration in glucose metabolism.

The absence of glycosuria during the glucose tolerance tests suggests that renal tubular reabsorption of glucose was not grossly diminished.

#### CONCLUSIONS

Mild alterations in glucose metabolism were commonly observed during ACTH and cortisone therapy in essentially normal young men. The fasting blood glucose was significantly elevated during cortisone therapy and during an intravenous infusion of ACTH. ACTH given intravenously with an oral dose of glucose produced significant hyperglycemia. No instances suggesting clinical diabetes mellitus were observed.

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## BOOK REVIEW

**The Kidney, Structure and Function in Health and Disease**, by Homer W. Smith, A. B., Sc. D., M. S., Professor of Physiology, New York University College of Medicine. 1049 pages; illustrated. Oxford University Press, New York 11, N. Y., publishers, 1951. Price \$12.50.

The author, a noted physiologist and outstanding authority on the function of the kidney in vertebrates, has scanned the experiments in renal physiology during the past quarter century and compiled a comprehensive volume relating to present concepts of this organ's regulatory and excretory operations. The scope of his research is reflected in the 2,300 bibliographic entries referred to and quoted literally. His concepts embrace the recent anatomic studies of circulation by Truett et al. and the physiologic effects of the steroid compounds of the adrenal cortex.

The text, after a short introduction discussing theories of renal function, is for some obscure reason presented in four sections. Part 1 covers basic anatomy, and renal clearances, experimental and determinative, in great detail. Part 2 covers the antidiuretic hormone and excretion of water, excretion of sodium and other electrolytes; the adrenal cortex and Addison's disease; and acid-base equilibrium in plasma and urine. Part 3 outlines the control of renal circulation and the action of drugs; trophic and other factors (including hormones and vitamins) related to function, renal function in infant and child; comparative physiology, and renal hemodynamics. Part 4 contains chapters on the disturbances of renal function during disease, including salt and water balance, disequilibrium in nonrenal diseases; chronic congestive heart failure, essential hypertension; the effects of traumatic and toxic injuries, "primary" diseases of the kidney and urinary tract; the anatomy, physiology, and significance of the juxtamedullary circulation; and a discussion of diuretics.

Illustrations are sparse, and consist mostly of graphs or charts. The print is large and clear. The bibliography is alphabetically arranged by author and includes the page number of the reference. Unfortunately for the medical profession this monumental work is essentially a reference volume, in which the author writes above the knowledge of the interest of the average student or physician. The reading is dry, the figures and arithmetic symbols necessary to the infinite experimental data are disconcerting, and the author makes no effort to emphasize conclusions to be drawn from the elaborate dissertations. In addition, the paucity of discussion of renal pathology and the presence of only one microphotograph will grieve the urologist and the internist, both eager to apply the products of such vast experimental research to their vexing clinical problems.—Lt. Col. C. W. Hoffman, MC, U. S. A.

# Chronic Granuloma Following Wound Contamination by Beryllium Silicate

Orland G. Davies, Jr., Captain, U. S. A. F. (MC) (1)

THE public health hazards of beryllium compounds have been emphasized by numerous authors in the past decade. Most of these reports are concerned with the inhalation of beryllium dust and the chemical pneumonitis which results (2-6), but in the past 5 years granulomatous lesions in the skin following lacerations produced by broken fluorescent bulbs have been reported (7-13). This lesion is being recognized with increasing frequency.

(1) U. S. Air Force Hospital, Hamilton Air Force Base, Hamilton, Calif.

(2) Van Ordstrand, H. S.; Hughes, R.; De Nardi, J. M.; and Carmody, M. G.: Beryllium poisoning. *J. A. M. A.* 129: 1084-1090, Dec. 15, 1945.

(3) Hardy, H. L., and Tabersaw, L. R.: Delayed chemical pneumonitis occurring in workers exposed to beryllium compounds. *J. Indust. Hyg. & Toxicol.* 28: 197-211, Sept. 1946.

(4) Martland, H. S.; Brodkin, H. A.; and Martland, H. S., Jr.: Occupational beryllium poisoning in New Jersey (with special reference to its incidence, diagnosis and compensation). *J. M. Soc. New Jersey* 45: 5-14, Jan. 1948.

(5) Titus, A. C.: Air contamination during machining of beryllium stainless steel. *J. Indust. Hyg. & Toxicol.* 30: 29-31, Jan. 1948.

(6) Gilman, L.: Beryllium (Glucinium). Occupation and Health Supplement. International Labor Office, Geneva, 1938.

(7) Nichol, A. D., and Dominguez, R.: Cutaneous granuloma from accidental contamination with beryllium phosphors. *J. A. M. A.* 140: 855-856, July 9, 1949.

(8) Fotsythe, W. E., and Adams, E. Q.: Fluorescent and Other Gaseous Discharge Lamps, New York and Toronto, Murray Hill Books, New York, N. Y., 1948.

(9) Grier, R. S.; Nash, P.; and Freeman, D. G.: Skin lesions in persons exposed to beryllium compounds. *J. Indust. Hyg. & Toxicol.* 30: 228-237, July 1948.

(10) Shook, C. F., and Powell, J. P.: Beryllium case. *Indust. Med.* 17: 403-404, Oct. 1948.

(11) Wounds contaminated by beryllium phosphors. (Queries and Minor Notes section) *J. A. M. A.* 139: 1047, Apr. 9, 1949.

(12) Coakley, W. A.; Shipton, R. N.; and Robertson, G. W.: Granuloma of skin at site of injury by fluorescent bulb. *J. A. M. A.* 139: 1147-1148, Apr. 23, 1949.

(13) Davis, C., and Grimes, O. F.: Skin granuloma following laceration by fluorescent lamp. *California Med.* 74: 203-205, Mar. 1951.

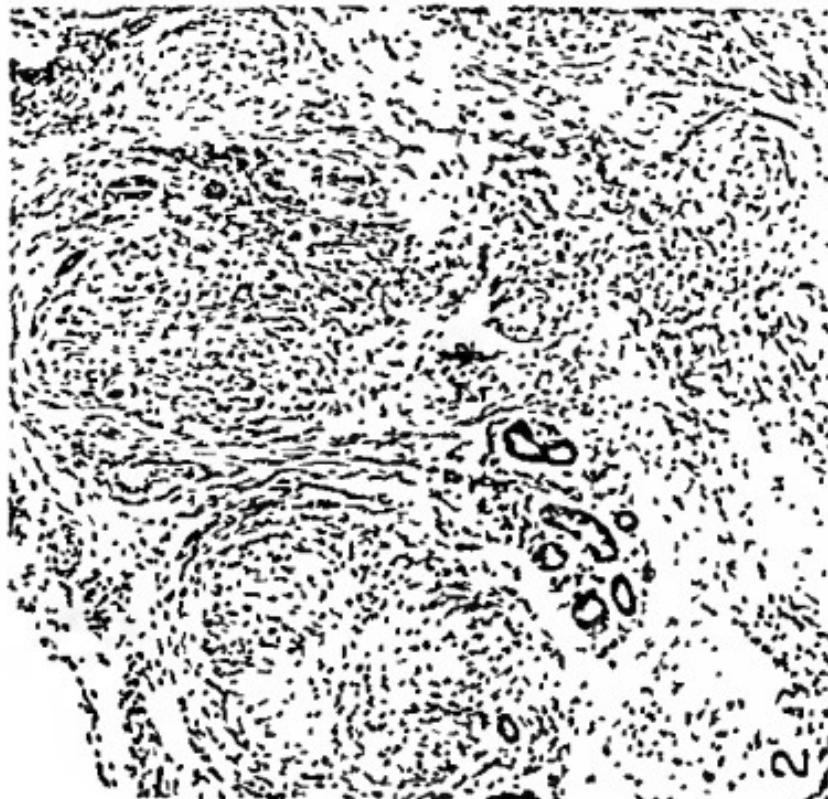


Figure 1. Low-power microscopic appearance of the lesion excised from the sole of the foot. Figure 2. High-power view of the same lesion showing the tubercle consisting of the epithelioid cells diffusely infiltrated with lymphocytes.

## CASE REPORT

In November 1950 a 20-year-old airmen was first seen in the outpatient department of this hospital because of a tender, inflamed scar on the medial aspect of the right foot. Eleven years prior to consultation he had cut his foot on a broken fluorescent lamp. This wound healed without delay and remained asymptomatic for the ensuing 8 years, then he noticed progressive redness, thickening, and tenderness of the scar. This lesion was excised under local anesthesia in November 1950 but the specimen was not examined microscopically. The postoperative scar remained tender, red, and indurated and ulceration and crusting persisted in its center.

In February 1951 the patient was again seen in the outpatient department at which time the scar was raised, tender, and inflamed and had a small central area of necrosis and crusting. Roentgenograms of the chest and foot, taken at this time, were normal. A presumptive diagnosis of "beryllium granuloma" was made despite the long latent period following the original injury. The area was again excised and microscopic examination of the tissue removed revealed an increased amount of deeply staining, collagenous material which was diffusely infiltrated by many epithelioid cells and lymphocytes. There were numerous non-caseating tubercles surrounding these hyalinized areas with occasional giant cells of the foreign-body type (figs. 1 and 2). A diagnosis of chronic granuloma of the skin consistent with beryllium granuloma was made. Special spectrographic studies of the urine and tissue removed as described by Fairhall (14) were not made.

In March 1951 the patient was seen in the outpatient department and the scar again showed the chronic inflammatory changes that were present before treatment. The area was again excised, this time giving a full 1 cm.-margin on all sides and extending to and including the deep fascia of the foot. Following this operation, the area healed and the resulting scar was normal in appearance.

(14) Fairhall, L. T., et al.: The toxicology of Beryllium. National Institute of Health Bulletin No. 181. Federal Security Agency, United States Public Health Service, Division of Industrial Hygiene, National Institute of Health, Washington, D. C., 1943.

## Scientific Award

On 27 November 1951 at the meeting of the American Pharmaceutical Manufacturers' Association in New York City, the Association presented a plaque to Dr. W. Randolph Lovelace, II, Chairman of the Armed Forces Medical Policy Council and a similar plaque to the Surgeon General of each of the Armed Forces. In accepting this award Dr. Lovelace said:

"On behalf of the Armed Forces Medical Policy Council, I wish to express sincere appreciation of this honor which the American Pharmaceutical Manufacturers' Association has bestowed on the medical services of the Armed Forces. It is with a feeling of deep gratification that I see the efforts of the individuals in these services so recognized, and I am confident that they will continue to make significant contributions to the advancement of medicine."

The inscription on the plaque read as follows:

1951 Scientific Award  
presented to the  
Medical Services of the Armed Forces  
(name of recipient)  
In recognition of the numerous scientific  
contributions in medical research, prophylactic  
and therapeutic practices and other life-saving  
measures which have vastly strengthened the  
defensive and combat forces of our nation  
by  
American Pharmaceutical Manufacturers'  
Association

s/ Howard B. Fonda  
Howard B. Fonda  
President

/s/ Martin Lasersohn, M. D.  
Martin Lasersohn, M. D.  
Chairman,  
Scientific and Research  
Award Committee

# History and Symbolism of the Naval Medical Corps Insignia

Daniel G. Miller, Lieutenant, junior grade, MC, U. S. N. R. (1)

EVER since the emergence of man into social groups he has used symbols with religious, mystical, or national connotations for veneration and inspiration. Medicine, from its deep prenatural roots has always been associated with characteristic symbols, some found almost universally in the ancient world. Nautical medicine may be traced back to the Phoenicians and Greeks who carried physicians aboard certain of their ships. Physicians of our Navy, descendants of these ancient seafaring physicians, have worn various symbols as medical insignia, and have changed these several times in the history of the Medical Corps. It is my purpose in this article to trace the evolution of the present medical insignia and examine its significance in the light of history and legend.

Naval uniforms in general made their appearance many centuries after armies had been entering battle in distinctive array. The Roman Legions were characterized by uniforms and Hannibal's Spanish troops wore crimson and white (2). Roddis (3) stated that it is not surprising that the navies lagged behind in the adoption of uniforms, for in the confines of the relatively small ships each man was known to the other, and the need for uniform dress was less apparent. Schoonmaker (4) states that "Locket is the authority for the statement that as early as 1603 King James ordered his principal masters of ships to be always bravely attired in liveries of scarlet cloth embellished with velvet, silk lace, buttons, and gold embroidery. The first official

(1) U. S. Naval Mine Depot, Yorktown, Va.

(2) Todd, F. T.: Uniforms. In Encyclopaedia Britannica. Encyclopaedia Britannica, Inc., Chicago, Ill., 1951, vol. 21, p. 703.

(3) Roddis, L.: A Short History of Nautical Medicine. Paul B. Hoeber, Inc., New York, N. Y., 1941, p. 332.

(4) Schoonmaker, W. N.: Naval uniforms; origin and development. U. S. Nav. Inst. Proc. 58: 509-527, Apr. 1932.

mention of uniforms in the British Navy seems to be in the Jacobite's Journal in 1748,<sup>10</sup> but these were for His Majesty's officers from admirals down to midshipmen, and uniforms for the men were not considered.

It is of value to include as ancillary information some of the changes that took place in naval uniforms in order to maintain the proper perspective on the development of the Medical Department insignia. Most of the material given below was found in the Department of Naval Records and History, National Archives. The first American naval uniform of which any record can be found is prescribed in a resolution of the Massachusetts Council of April, 1776, which "Resolved that the uniform of the officers be green and white . . . ." Thus began an unbroken naval tradition for lack of explicitness in uniform regulations. In 1776 the Marine Committee of the Second Continental Congress issued the first official uniform regulations for the Navy. These provided that the officers should wear blue coats with yellow buttons, blue breeches, and a red waistcoat. It is notable that gold lace is absent, and this displeased many captains, including John Paul Jones, who favored a more elegant uniform. The officers wore what they pleased in spite of these regulations, and our infant Congress, gathering federal authority, passed this determined resolution (s) in 1781:

"That after the first day of January 1782, any officer whatsoever in the service of the United States, who shall wear on his clothes any gold or lace embroidery or vellum, other than such as Congress or the Commander-in-Chief of the Army or Navy shall direct, or who shall wear any uniform worn by the British Army or Navy, shall be cashiered from the service."

Naval affairs after the Revolutionary War were conducted by the Secretary of War. In June 1797 he issued regulations governing the uniforms of naval officers. They provided for a blue uniform with buttons of yellow metal having a foul anchor and an American eagle on them. The captains added gold epaulets to this simple uniform. When the Navy Department was established on 30 April 1798, it assumed the function of providing naval uniform regulations. In 1802 the second Secretary of the Navy issued uniform regulations more in keeping with the desires of the officers. The coat was elaborately trimmed in gold lace and had a row of buttons around the cuff. The uniform of the surgeons of that day was similar to that of the captains of the line. The essential difference between the two lay in the absence of gold lace and fewer buttons in various parts of the surgeons' uniform.

The uniform regulations of 23 November 1813 were not remarkable other than that gold lace was belatedly added to the surgeon's uniform and white pantaloons were prescribed as an alternative to breeches.

The latter, however, are of no moment because a monument in Trajan's Forum in Rome and various Persian seals (ca. 500 B. C.) show soldiers in baggy trousers (5).

In 1830 the oak leaf and acorn first appeared on naval officers' uniforms. Leaves of live oak, interspersed with acorns were embroidered on the collars and cuffs of all officers in greater or less degree, according to rank. The influence of this early custom is seen today on the visors of caps of officers of the rank of commander and above. Certain corps insignia were designated at that time to be worn with the oak leaves and acorns. Line officers wore a foul anchor and stars on their collars; pursers, a cornucopia. As a corps insignia, medical officers wore the staff of Aesculapius, which had first been introduced in 1826. Of this insignia, Roddis (6) said that it was disproportionately large, and "was probably the ugliest device ever worn, and a patient, especially if his gastritis had been induced by alcohol, would have been sorely distressed by the huge snake on the medical attendant's collar." The then Norfolk Naval Hospital in Portsmouth, Va., constructed in 1830, was probably the only naval hospital to have the benefit of serpent-bedecked medical officers because the use of this device was abrogated in 1832. In its place a branch of live oak was substituted and gold lace was added to the surgeon's cuffs.

The next uniform change was ordered in 1841. The uniform again became plain and, except for the surgeon's, lost most of the gold lace which had previously ornamented it. These regulations did not prove satisfactory, especially that part which provided only buttons on the cuffs of captains and commanders of the line, while the doctors had 3 stripes of gold lace. This latter was the distinctive mark of a Spanish colonel and in Spanish ports it frequently happened that the guard was turned out and full military honor was paid to the doctor while the captain passed by unnoticed (4).

In 1847, 5 years after the establishment of the Bureau of Medicine and Surgery, the lace on the cuffs of the medical officers was removed and sprigs of live oak substituted. In addition, they were to wear gold epaulets with the letters "M. D." in old English characters, done in solid silver and mounted on a crescent. The cap device was the same as that of the line officers, an oak sprig surrounded by a wreath of olive and oak. In September 1852, the "M. D." lettering was replaced by a sprig of olive. By this time the medical officer was a walking arboretum.

Regulations were issued in 1862 by which staff officers' uniforms were the same as those prescribed for the line except that the officers

(5) Devices and uniforms of the Navy Medical Corps, 1802-1905. U. S. Nav. M. Bull. 13: 505-513, July 1919.

(6) See p. 331 of footnote reference (3).

wore a plain rather than a foul anchor in the wreath of their caps and the star worn above the gold lace was omitted on the sleeves of the staff officer. Thus while a distinction was made between the staff and line, there was no insignia to distinguish the different corps. The various corps were again assigned insignia in January 1864. Officers of the Medical Corps wore a silver oak leaf in a vertical position within the gold wreath of their caps, but they did not wear the corps device above the sleeve stripes or on the shoulder straps as did line and other staff officers. Thus when the uniform regulations of 1866 specified that the cap ornament for all commissioned officers (except naval constructors, chaplains, and professors of mathematics) should consist of a silver eagle on a gold foul anchor, the medical officers were again left without any distinguishing device. They wore only the grade insignia which appeared also on the uniforms of other officers, both staff and line, with whom they had assimilated rank.

That these uniform changes, desultory as they may seem, were not easily come by is evidenced by the "feud" in the Navy Department during Civil War years between Secretary Welles who advocated "republican simplicity" and Rear Admiral Porter, representing the officers, who stated that "They would rather live on a smaller scale than to be deprived of a uniform which adds to their respectability." The issue was settled when Admiral Farragut, for whom this rank was created, was consulted in regard to his uniform. He suggested for his sleeve mark a large gold embroidered star with the representation of his favorite ship, the *Hartford*, in silver in the center. In addition, he was given gold lace which extended up to his elbows on his full dress coat (4).

In 1869 regulations were issued which prescribed a more uniform dress for both staff and line officers, but still left the medical officer without a corps device. Instead, while line officers wore the gold star above their stripes, staff officers wore colored cloth underneath their sleeve stripes in such a manner that it would show on each side and between the stripes. The color designated for the Medical Corps was cobalt blue.

The next change in Medical Corps insignia came in 1883 when the cobalt blue cloth was replaced by maroon velvet, and a distinctive device was introduced. This was a small Geneva cross of maroon velvet set within a silver Maltese cross. This was a combination of crosses, both of which had medical significance. The red cross of Geneva (5, 7), connoting immunity in battle for medical personnel, was adopted by the Geneva Convention in 1864. This convention was the result of a movement to improve the conditions of wounded soldiers in the field. The movement sprang from the publication in 1862 of a

(7) The Geneva Convention. In Encyclopaedia Britannica. Encyclopaedia Britannica, Inc., Chicago, Ill., 1951, vol. 16 p. 114

book, *Un Souvenir de Solférino*, by Henri Dunant, a philanthropist of Geneva. In this book he described the suffering of the wounded in the Battle of Solférino so vividly that a great deal of public interest was aroused, and with the support of Queen Augusta of Prussia, and the Grand Duchess Maria Pavlovna of Russia, this general interest was channeled into a fruitful convention. The cross was taken from the flag of Switzerland out of appreciation for the part that Republic played in organizing the first international effort to make warfare more humane. The Maltese cross (5, 8) was the emblem of the Knights of Malta. Many organizations grew up during or after the crusades to aid and comfort pilgrims to the Holy Land. The Knights of Jerusalem, known as the Hospitalers, was one of the larger and better organized of these groups, and from this order grew the Knights of Malta.

This device was used for only 3 years. In 1886 it was replaced by the present insignia, uniform regulations calling for "a spread oak leaf embroidered in dead gold, with an acorn in silver upon it." This corps device was worn on the epaulets, shoulder straps, and collars; it was not until 1919 that the dark maroon velvet under the gold stripes of medical officers was removed and the corps insignia placed just above the stripes, where it is worn today.

Other than our own Navy, few have a distinctive device for the medical corps. Medical officers in the Brazilian Navy wear an embroidered stethoscope above their sleeve stripes, and in the Netherlands, Yugoslavia, and the former German Navies, the staff of Aesculapius is worn similarly. In most other navies colored cloth is worn between the sleeve stripes to distinguish medical officers: for Great Britain, scarlet cloth; France, green velvet; Greece, purple velvet; and Italy, blue cloth. Naval medical officers in Russia wear a dark gray band piped with red on their caps, and similar collar tabs (9).

The various changes that have taken place in the Medical Corps insignia may be summarized as follows:

- 1776 to 1826 None.
- 1826 to 1832 The staff of Aesculapius.
- 1832 to 1847 A branch of oak.
- 1847 to 1852 The letters "M. D." in solid silver.
- 1852 to 1862 An olive sprig.
- 1862 to 1864 None.
- 1864 to 1866 A silver oak leaf within the wreath of the cap.
- 1866 to 1869 None.
- 1869 to 1883 Cobalt blue cloth between the gold sleeve lace.
- 1883 to 1886 The Maltese and Geneva crosses, maroon velvet between the gold lace.

(8) The Cross. In *Encyclopaedia Britannica*. Encyclopaedia Britannica, Inc., Chicago, Ill., 1951, vol. 6, p. 753.

(9) See pp. 336-337 of footnote reference (3).

1886 to 19f9 Oak leaf and acorn, maroon velvet.

19f9 to the

present Oak leaf and acorn.

Historical records do not reveal what significance or imaginative fancy lies behind the afore-mentioned changes in the Medical Corps insignia. We overreach ourselves to ascribe poetical connotations to many of the uniform traditions which had their origin in caprice or convenience. Many a seafaring man will wax eloquent on why, for example, the navy uniform is blue, but Schoonmaker (4) gives us what is probably the unpoetic truth, that it was taken from the riding habit of the Duchess of Bedford. Admiral Forbes, in 1746, was summoned to attend the Duke of Bedford. He was introduced to an apartment filled with various dresses, and his opinion was asked as to the most appropriate color. The Admiral said, "Red and blue, for they are our national colors."

"No," replied the Duke, "the King has determined otherwise, for having seen my Duchess riding in the park a few days ago in a habit of blue faced with white, it took his Majesty's fancy and he has appointed it for the uniform of the Royal Navy."

Naval metallic rank devices were no doubt adopted from the Army. In Army traditions the symbolism of these insignia has assumed legendary proportions and is expressed by this fanciful tale:

"The second lieutenant (corresponding to the ensign in the Navy) stands on the level ground looking up to his superiors at varying altitudes above him and starts to climb. His first step up corresponds to the first bar of the fence, giving him his first bar (10), the lieutenant's bar \* \* \*. The second step up to the top of the fence gives him his two bars as a captain (lieutenant in the Navy). From the fence he climbs to the oak, the tree of might and strength. It is a long climb and symbolizes the differences that exist between the company officer and the field officer. The gold leaf on the major's (lieutenant commander in the Navy) shoulder symbolizes this position. The next step is to climb to the tallest tree of the forest, the straight towering silver poplar which has no branches for many feet. At the top of this the lieutenant colonel (commander in the Navy) finds his silver leaves and looking up above him sees the soaring eagles, the insignia of colonel of the Army (captain of the Navy); and above the eagle the stars in the sky, the insignia of the highest rank in both the Army and the Navy." (4)

Rather than attempt to create a tradition by conjecture or poetry, we shall examine the oak leaf and acorn from the viewpoint of historical symbolism and heraldry and see then what conclusions may be drawn. Medicine and religion, both springing from a need for outside assistance, have always been and should be closely associated. In

(10) Silver Lieutenant, junior grade, in the Navy.

ancient societies they were usually synonymous. The early priest-physician played a prominent role in those communities. Objects in nature which men felt could help them in their struggle for survival were revered. These objects, or symbolic representations thereof, were entrusted to the priest-physician whose profound wisdom might enable him to obtain for the worshippers the favor and assistance of the supernatural powers. It would follow then that whatever country would prevail in armed contest had the most potent gods, whose favor the defeated would endeavor to incur. Christians and Jews, however, in Western Civilization treasured their divine gifts beyond material gains or strength of arms. Their treasures, in the written word of both Testaments, have sustained these peoples with undiminished vigor though the swords of centuries have rusted. Medicine, however, does not progress by divine revelation. Rather we stand on the summit of the ages of wizardry, metaphysics, and empiricism through which our medical ancestors have travelled. It is with venation that we preserve the symbols of the hundreds of physicians who earnestly ministered to the sick, and who in their day added to medical science even as we today stand at that ever receding but never ending frontier.

The staff of Aesculapius and the caduceus are two of the most commonly accepted symbols of medicine. The association of the oak leaf with medicine is not so generally well known although its roots are just as deep. The Red Cross of Geneva has been mentioned previously.

The serpent-entwined staff and the oak leaf symbolize certain vague groups of mystic or magical processes which in the cult of prehistoric men preceded medicine in our sense of the word but were certainly inclusive of it. The ubiquity of these symbols in ancient civilizations is remarkable. Much material on serpent worship is recorded by Fergusson (11) and Scheiret (12). Early Babylonian figures show the caduceus not as an emblem, but as a god in itself; in others it is carried in the hands of gods or goddesses as a sign of supernatural powers. This staff in its oldest form was a rod ending in two prongs entwined into a knot. The Babylonian myths associated the serpent with wisdom just as the story of Genesis does. In India, serpents were held to be the progenitors of kings. The serpent was sacred to nearly all the gods, both Egyptian and Grecian. It represented immortality, owing perhaps to its periodic shedding of the skin; and eternity was typified by the snake swallowing its own tail. In various places the serpent represented knowledge and culture, shrewdness and wisdom, and freedom from disease. Some ancient groups felt that the human soul after death was re-embodied in a snake; others, that to eat a snake was to acquire powers of healing. The serpent was connected with all sorts of mysterious religious rites and closely connected with the healing arts (5). We

(11) Fergusson, J.: *Tree and Serpent Worship, or Illustrations of Mythology and Art in India in the First and Fourth Centuries after Christ*. W. H. Allen & Co., Publishers to the India Office, London, 1873.

(12) Scheiret, G. A.: *The Caduceus*. Bull. U. S. Army M. Dept. 32: 26-33. July 1935.

have the biblical record (13) of Moses raising up a brazen serpent before the children of Israel to protect them against snakebite. Even in Christian times and among Christian nations this strange influence was felt. For example, as late as 1890, serpents were burned at mid-summer festivals to ward off evil (14).

In Greek mythology, Apollo, the sun god, carried a staff or wand which exercised influence over the living and dead. Apollo, first victor of the Olympic games, was not only a great athlete but was also god of the healing art, "Physician and Seer," "Health Giver," "Averter of Evil," and last but not least, "Physician of the Soul." Evidently Apollo found that his duties as a physician interfered with his sporting activities, and so he gave his wand to Mercury in exchange for a lyre. Mercury, while carrying this wand, came upon two serpents knotted together while fighting, and he separated them with his wand. Mythologists say that serpents were added to the staff at this time. A pair of wings was sometimes attached to the top of the staff in token of the speed of Mercury. Physicians today, we believe, would gladly give Mercury his caduceus in exchange for his winged shoes.

Aesculapius, Apollo's son, became the legendary Greek god of medicine. In the temples erected to him he effected cures and prescribed remedies. His daughter, Hygeia, was the goddess of health. While Aesculapius was treating a patient one day, a snake appeared and entwined about his walking stick, thus conferring on him the gift of wisdom and establishing the staff of Aesculapius as a classical symbol of medicine.

The caduceus of Mercury was first associated with medicine in the sixteenth century, when it made its appearance on the title pages of medical books. The first physician to employ the caduceus on his crest was Sir William Butts, physician to Henry VIII. In 1857 Army regulations directed that the caduceus be part of the insignia for hospital stewards. But it was not until 1902 that the caduceus was adopted as the insignia for the medical officers of the Army (15).

Reverence of trees among early civilizations was just as widespread as that of serpents; and among trees, the oak was most frequently worshipped. Ancient documents give many examples of the esteem in which the oak was held for its religious significance and healing powers.

We read in Genesis (16) that when Abraham entered the land of Canaan, God appeared to him under an oak to promise possession of the country to his posterity. The Lord also appeared before Abraham

(13) Numbers 21:6-9.

(14) Frazer, Sir J. G.: *The Golden Bough*. Macmillan Co., New York, N. Y. 1922. vol. II, p. 38.

(15) *The Caduceus*. Bull. U. S. Army M. Dept. 41: 105-106, Oct. 1937.

(16) Genesis 12:6, 7.

at the oak of Mamre (17), at which time Abraham pleaded with the Lord not to destroy Sodom if so many as 10 righteous people be found there. The locations are translated in the King James version as the plains of Moreh and Mamre, but in the Hebrew it is oak. To show his subservience to God, Jacob buried all the graven images in his household beneath the oak at Shechem (18). By the oak at Beth-El, Deborah was buried (19). Joshua "took a great stone, and set it up there under an oak, that was by the sanctuary of the Lord" (20). Again, beneath the oak at Ophrah, the angel of the Lord appeared to Gideon, telling him that he, Gideon, had been chosen by the Lord to save Israel from the hand of the Midianites (21).

It would appear, therefore, that among the ancient Hebrews the oak was regarded as symbolic of the divine covenant, and some historians believe that by association it came to signify the divine presence. Barlow (22), an authority on symbolism, stated that the Hebrew word, *allon*, which means oak also means oath, and that the root of this word, *al*, meaning mighty or strong, is the origin of the name of deity in many ancient tongues.

The Greeks, too, had a mystic veneration for the oak. Their supreme deity, Zeus, was said to dwell within the oak at Dodona, and the priests of the oracle gave forth their declarations on its leaves. Ovid, in a stirring passage in the *Metamorphoses*, relates the story of the plague of Aegina, telling how the king, Aeacus, standing beneath "a branching oak, the Sire's own tree, from seed of old Dodona sprung," makes an impassioned plea to Zeus to save his people from the plague or to let him die with them, and "the lofty oak trembled and moved its branches in the windless air." In ancient Rome, according to Livy, Jupiter was worshipped in the form of a lofty oak tree which grew up in the capital. Wood only of oak was used by the vestal virgins for their perpetual fire (23).

Large oak forests covered Northern Europe at the dawn of history and these majestic trees exercised a profound influence on the people who dwelt in their shadows. The primitive Europeans, Frazer (24) tells us, lived among oak woods, used oak sticks for lighting their fires, and oak timber for the construction of their villages, their roads, and their canoes; they fed their swine on the acorns, and themselves ate acorns and made flour of it. No wonder then if the tree from which

(17) Genesis 18: 1.

(18) Genesis 35: 4.

(19) Genesis 35: 8.

(20) Joshua 24: 26.

(21) Judges 6: 11-18.

(22) Barlow, H. C.: *Essays on Symbolism*. Williams and Norgate, London, 1866, p. 83.

(23) Hazen, J. T.: *The oak*. In the *Standard Dictionary of Folklore, Mythology and Legend*. Funk & Wagnalls Co., New York, N. Y., 1950, p. 806.

(24) Frazer, Sir J. G.: *The Golden Bough*. Macmillan Co., New York, N. Y., 1922, vol. 1, pp. 353-356.

they received so many benefits should play an important part in their religion, and be invested with a sacred character.

Taara, the supreme god of the Finns and the Estonians, was associated with the oak, and the same is true of the Norse god, Balder, at whose death men, animals, and plants wept. The principal god of the ancient Germans was supposed to dwell by preference in the great oak at Romove, before which a sacred order of priests kept a continual fire of oak logs. The oak was veiled from view like the pictures in a modern continental church, and only shown from time to time to worshippers. The grove where it stood was so sacred that only the consecrated were allowed to enter, and no branch on it might be injured (25). A vestige of the superstitious reverence for the oak in Germany is the custom of passing sick people or animals through a natural or artificial opening in the trunk of an oak for the purpose of healing them of their infirmities (26).

Nowhere was the worship of the oak more developed than among the druids. Druidism was the religion of the Celtic inhabitants of Gaul, Britain, and Ireland up to the time of Roman conquest or in areas apart from the Roman influence, up to the time of the introduction of Christianity. Information concerning the druids comes from contemporary observers and from archaeological investigations for the words of the druids are not extant. The druids of Gaul did not commit their learning to writing, holding that learning from the written word dulled the mind; they preferred to rote-tue their disciples over a score of years in the learning of some 20,000 verses by memory (27, 28). Thus when the masters and the disciples fell before the onslaught of the Romans, the teachings were lost also. In Britain and Ireland, the druids kept written records, but these, too, were destroyed by the Romans and in subsequent efforts to establish Christianity on these islands. So great was their power that even St. Patrick implored God to protect him against their conjurations, and to stop the teachings of the druids, he destroyed 180 of their books (29). Eventually all druidic literature was destroyed or lost.

The nature of the early history of druidism is open to conjecture, but Pokorny (29), in a closely reasoned argument, stated that the druids were the priests or medicine men of the Neolithic aborigines of the British Isles, and at that time the oak was not holy to them. About the fourth or fifth centuries, B. C., the Celtic invasions of Britain took place and these Indo-Europeans assimilated with the aborigines.

(25) Philpot, J. H.: *The Sacred Tree, or the Tree as Religion and Myth*. Macmillan Co., New York, N. Y., 1897. p. 44.

(26) See p. 371 of footnote reference (23).

(27) Howard, J. E.: *The Druids and Their Religion*. Samuel Bagster & Sons, London, 1905. p. 22.

(28) Julius Caesar: *De Bello Gallico* 6: 16.

(29) Pokorny, J.: *Origins of Druidism*. Annual Report, Smithsonian Institution, Washington, D. C., 1910. pp. 583-597.

The great beauty and charm of the women of these aborigines, Pokorny avers, probably had a great deal to do with the fact that the Celts assimilated rather than held the aborigines as servile plebs as they did in other countries. With them the Celts brought oak and grove worship, and the druids soon amalgamated these practices into their own religion which remained dominant. It was a case of the conqueror being conquered by the women and the religion of the vanquished land. The function of the druids as physicians was closely connected with their calling as conjurors and prophets. One of their important ceremonies as priests and medicine men was described by Pliny the Elder:

"The Druids (so they call their wise men) hold nothing in greater reverence than the mistletoe, and the tree on which it grows so that it be an oak. They choose forests of oak for the sake of the tree itself and perform no sacred rites without oak leaves, so that it may be supposed that they get their name from the Greek word meaning 'oak'; but further, anything growing on oak trees they hold to be sent from heaven and to be a sign that the particular tree has been chosen by God himself. Mistletoe is, however, rather seldom found on an oak tree, and when it is discovered it is gathered with great ceremony, and particularly on the sixth day of the moon \* \* \*. Hailing the moon in a native word that means 'healing all things' they prepare a ritual sacrifice and banquet beneath a tree and bring up two white bulls, whose horns are for the first time garnished. A priest arrayed in white vestments ascends the tree and cuts the mistletoe with a golden knife; it is caught in a white cloak. Then finally they kill the victims, praying to their deity to tender propitious his gift to those on whom he has bestowed it. They believe that mistletoe given in drink will impart fertility to any animal that is barren, and that it is an antidote for all poisons."

It might seem from the above that the mistletoe would be an appropriate emblem for the Medical Department—and while this would no doubt find much favor among many of the younger members of the Department, the far-reaching social implications, we are sure, would preclude the hasty adoption of such a device.

With the imposition of Roman civilization which followed their conquests, and the advent of Christianity, the nature of druidism changed. This change is accurately reflected in the change of the meaning of the word "druid." Contrary to the etymology suggested by Pliny, "druid" was derived originally from the Gaelic meaning "supreme, wise," revealing the reverence with which their lofty doctrines were held (29). However, their administrative and other civil functions were taken over by the Romans, who also physically destroyed and dispersed them; their religion was supplanted by Christianity, which forbade their teachings. Consequently in the early centuries of the Common Era they had so degenerated that the Gaelic *druid*

stood for magician or sorcerer, and in later Welsh the word *druidecht* came to mean the arts of magic (30).

After the decline of Rome, Britain was invaded in rapid succession by the Angles, Saxons, and Jutes, and by the time of the Norman invasion in 1066, the country was almost entirely converted to Christianity and all mention of druidism had virtually disappeared from British literature. But the old associations of things holy with trees and groves persisted in the minds of the people of Britain and France despite many edicts and canons condemning it (31). Finally the Church adapted these practices to her own purpose (32). Even today remnants of these ancient beliefs may be found in the customs of the people of Brittany and the British Isles. In Wales, some people believe that rubbing a piece of oak in the palm of the left hand in silence on Midsummer Day will keep them free from disease throughout the year. A nail driven into an oak, it is said in Cornwall, will rid a patient of a toothache. In Surrey, it is believed that certain tumorlike growths found on the trunks of oaks will guard against gout if carried in the pocket. Parkinson (33), in his *herbal*, recommended a confection made from leaf galls to cure melancholy and sorrows arising from no evident cause. Barlow (34) stated that as late as the Eighteenth Century, "holy oak" was a common household word in England, and that oaks were synonymous with "gospel trees." Hertick (35) alluded to this in his *Hesperides*:

"Deatest, bury me under that Holy-oake, or Gospel-tree,  
Whete (though thou see'st not) thou may'st think on me  
When thou yearly go'st processioning."

In Germany as in England, the oak long remained a sacred tree; solemn assemblies were held beneath it and decrees were often dated *sub quercus* or *sub annosa quercu*. In Ireland today there are more than 1,300 places the names of which have "derry" in them. This is the anglicized *doire* or *daire* meaning oakwood (29). It is not surprising then that the oak played a prominent part in the heraldry of the Middle Ages. The oak was the Scottish clan badge of the Cameron, Buchanan, and Stewart families. On an anonymous roll of arms was written the following:

"The shield is formed of polished gold, on which a ruby mapple glows.

In this a honeysucklebold, its charm in native fullness shows;  
And in each corner of the chief—  
In base as well, in bold relief,  
An oak-leaf lies with bravery true  
Which nerves the heart of one who'd gain  
The bondage of affections chain.\*

(30) Astley, H. J. D.: *Biblical Anthropology*. Oxford University Press, New York, N. Y., 1929, p. 178.

(31) Arles, 452; Tours, 567; Council at Naisses, 658; Toledo, 692; Canon of Edgar, 967.

Newton (36) in his work on heraldry stated:

"Of trees the oak is pre-eminent, as monarch of the forest. It is a symbol of strength and of long tried fidelity, which by its appropriation may figuratively imply the worthiness of the original bearer, or allude to the lands which have been bestowed upon him for his good services."

The oak tree is about 20 years old before it bears acorns. In folklore and legend the acorn is the symbol of prolonged effort preceding perfect achievement—an appropriate model of perfection for physicians. It was common medieval heraldic practice to adorn a leaf with the fruit of its plant or tree; any charge so decorated was said to be "acorned" of *englanté*. The acorn, therefore, also a symbol of fertility, was frequently placed on the oak leaf. The druids, it should be noted, ate acorns of the sacred oak in preparation for prophesying (37).

In addition to its other connotations, the oak has a particular naval association. Rothery (38) stated that the oaks were honored among most nations and that the Greeks and Romans formed acorned oak branches into crowns and awarded them to the victors. Owing to the tree's suitability for boat building, it was particularly associated with naval exploits. In a dramatic passage, Tyas (39) exclaimed:

"If we do but remember the wooden halls of old England, we must allow that the oak has the first claim to be made the emblem of bravery. That tree bears no gorgeous flower, and its knotted and gnarled branches are not very traceable substances to be imported by the aid of the pencil to our shields. We are, therefore, compelled to content ourselves with the oak leaf, which may well represent the brave hearts of our countrymen who have maintained the supremacy of England over the wide waste of waters where they have been borne about by the tough timber which our noble forests have produced."

We have seen the association of the oak with medicine and religion in the heritage of our Western civilization as it grew and spread from ancient Palestine to Greece and Rome, from the Teutonic and Scandinavian peoples to the Celtic groups of France and the British Isles.

(32) See p. 180 of footnote reference (29).

(33) Parkinson. Quoted in footnote reference (22).

(34) See p. 92 of footnote reference (21).

(35) Herrick, R.: To Anthea (in the Hesperides). In Mootman, F. W. (editor): The Poetical Works of Robert Herrick. Oxford University Press, New York, N. Y., 1921. p. 20.

(36) Newton, W.: Display of Heraldry. William Pickett, London, 1846. p. 138.

(37) Standard Dictionary of Folklore, Mythology and Legend, Funk & Wagnalls Co., New York, N. Y., 1949. p. 7.

(38) Rothery, G. C.: A B C of Heraldry. Cornhill Publishing Co., Boston, Mass. 1915. p. 121.

(39) Tyas, R.: Flowers and Heraldry. Houston & Stoneman, London, 1851. p. 181.

but more than that, the unique association of the oak with the hoary traditions of the sea is demonstrated. We may, therefore, conclude that the acorned oak leaf, with its proud and ancient ties with medicine and with the sea, is a valid and significant insignia for the Medical Corps of the Navy.

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## BOOK REVIEW

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**Biological Antagonism, The Theory of Biological Relativity,** by Gustav J. Martin, Sc. D., Research Director, The National Drug Company, Philadelphia, Pa. 516 pages. The Blakiston Co., Philadelphia, Pa., publisher, 1951. Price \$8.50.

The author of this volume has consolidated in a single text the theory of osiologic relativity, the availability of which will place at the disposal of the pharmacologist, biochemist, and immunologist, a comprehensive metabolite analogue in the field of displacement that may lead to discoveries of chemotherapeutic agents of great value in medicine and its allied sciences. The book is well written and emphasis is placed on the pharmacologic aspects of this theory as early as chapter 2, in which the distinction between pharmacology and toxicology, as associated with chemotherapeutic agents altering enzymatic mechanisms, is clearly defined. In addition, due notice has been given to those agents altering enzymatic mechanisms associated with the parasympathetic and sympathetic nervous systems, those associated with histamine, and to biologic antagonism as it relates to the pharmacology of narcotics and hypnotics. Subsequent chapters of this book fully cover the physiologic similarity of the chemical products of metabolism. I believe the primary thought of the author throughout the book is to show that the metabolism of action of biologic antagonists, and more specifically of displacement compounds, is in the alteration of the kinetics of enzymes. This book should be available to the student and specialist alike as a reference work in the field of biologic antagonists and relativity.—J. A. Keeney, Ph. G.

# Hemorrhage From the Nasopharynx

Edgar L. Olson, *Colonel, U. S. A. F. (MC)* (1)

**A**LTHOUGH epistaxis is usually not severe and is generally easily controlled, occasions have arisen when control of nasal hemorrhage has constituted a major problem. Deaths are rare from this cause unless the hemorrhage is of the angiomatous type, in which case the mortality is about 4 percent. Bleeding occurs most often from the anterior portion of the nasal septum, but occasionally originates from other sites such as that described in the case report which follows. This site was relatively inaccessible and produced an extremely profuse flow of blood. The measures necessary to control this hemorrhage were more drastic than those usually used to control epistaxis.

## CASE REPORT

A 26-year-old woman was brought to the ear, nose, and throat clinic at about 1700 hours on 28 March 1951 with profuse bleeding from the nose and mouth. She appeared to have lost a great deal of blood. She had reported to the aid station in the area where she worked at about 1545 hours and was bleeding profusely at that time. The nurse's attempts to stop the bleeding were unsuccessful. A medical officer in the area was called. He packed both nasal chambers with vaseline gauze, but also failed to stop the bleeding. The nurse estimated that the patient had lost about 3 pints of blood by the time she was brought to the clinic as she had vomited a complete emesis basin of fresh clotted and unclotted blood. History obtained later from the patient revealed that she had had intermittent nosebleeds since childhood, but none severe enough to require medical attention, and that she had had a profuse nosebleed, lasting about 20 minutes, early in the morning of the day she was seen in the afternoon. The hemorrhage recurred in the afternoon quite suddenly and was so severe that she reported to the aid station within 10 minutes of the time of onset.

Examination on arrival revealed an extremely pale, anxious young woman, with cold, clammy skin, bleeding quite profusely from the nose and throat, with a weak, thready, and accelerated pulse. She was in

(1) United States Air Force Hospital, Wright-Patterson Air Force Base, Dayton, Ohio.

shock and was immediately removed to the operating room. The laboratory was asked to send a technician to the operating room to obtain blood for typing and crossmatching. After about 10 minutes spent in preparing the operating room, all nasal packing was removed. With difficulty, because of the profuse bleeding, the bleeding point was located on what appeared to be the left lateral or superior wall of the nasopharynx or both. The site of the bleeding point accounted for the previous unsuccessful effort to control the hemorrhage with nasal packing alone. A nasopharyngeal pack was inserted and both nasal chambers were repacked with vaseline gauze.

The nasopharyngeal pack was similar to those used for children after tonsillectomy and adenoidectomy. This type of pack is easily made by folding a 4 by 4 inch piece of gauze and trimming sufficiently so that it will exactly fit the nasopharynx to be packed. Strong black silk thread is used to tie the pack in a firm roll. Two long threads are attached, one to each end of the pack, to extend from each nares and another thread is attached to extend from the throat. The pack is inserted in the nasopharynx by first inserting a small rubber catheter through one nare into the pharynx and tying one of the threads to it and pulling it out the nose. This procedure is repeated on the other side. Then, while an assistant pulls on the two threads coming from the nares, the operator pushes the pack snugly into place in the nasopharynx. A piece of gauze should be placed over the columella before tying the two threads extending from the nares. The thread extending from the mouth is taped to the side of the face. When it is time to remove the pack, the thread at the columella is cut, and the pack is pulled out with the thread extending from the mouth. If the thread breaks, a curved Kelly hemostat is inserted behind the soft palate, and the pack grasped and removed.

This procedure immediately controlled the bleeding, and the patient was removed to the recovery ward. Because she had lost an estimated additional quart of blood, mostly vomited while she was in the operating room, an immediate transfusion of 500 cc. of blood and 1,000 cc. of 5 percent dextrose in saline solution were given. Seventy-five milligrams of vitamin K was given at once and 25 mg. every 3 hours thereafter. The patient's blood pressure was 104/70 and her pulse 96 soon after returning to the ward. By 2200 hours her blood pressure was 120/60 and her pulse 88. All packing was removed on the morning of the second postoperative day. Convalescence was without sequelae or complications. Laboratory findings failed to help in establishing a cause for the bleeding. The erythrocyte count was 3,410,000 and the leukocyte count was 15,700 with 82 percent neutrophils, 17 percent lymphocytes, and 1 percent monocytes. The hemoglobin was 14. The bleeding time was 2 minutes. The coagulation time was 3 minutes. The platelet count was 190,560. The prothrombin time was 16 seconds (control time 16 seconds).

The patient was discharged on 31 March and has been carefully examined twice since that time, the last time being on 14 May. No cause for the bleeding has been found and there has been no recurrence.

#### SUMMARY

This case is reported because of the unusual location of what appeared to be a nosebleed and to focus attention on the seriousness of some nosebleeds. The measures used to control the bleeding in this case may help to save a life in a similar emergency.

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#### BOOK REVIEWS

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**Thyroid Function and Its Possible Role in Vascular Degeneration**, by William B. Kountz, M.D., Assistant Professor of Clinical Medicine, Washington University School of Medicine; Director of Clinical Services, Division of Gerontology, Washington University School of Medicine and the St. Louis City Infirmary Hospital, Consulting Physician, Barnes Hospital and Lutheran Hospital, St. Louis, Mo. American Lecture Series Publication No. 108, A Monograph in American Lectures in Circulation. 62 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1951. Price \$2.25.

The author is of the opinion that too little interest exists regarding the role which internal metabolism and blood supply of the blood vessel wall plays in arterial degeneration. Hopeful of inspiring further research in this field, he presents the result of his 5-year study of patients in 3 age groups. Thyroid was administered to those patients with a low basal metabolic rate and an elevated blood cholesterol. The first group consisted of business executives whose average age was 55 years and in whom no or only moderate arterial changes were demonstrated. The second group were of an average age of 61 years and in most instances showed evidence of moderately advanced vascular disease. Many of these had symptoms which could be attributed to their vascular tree. The patients in the third group with an average age of 67.3 years, all showed an advanced vascular degeneration, both on clinical and laboratory examination. In the first group the incidence of vascular accidents, over a 5-year period, was less in the treated group. Coronary thrombosis occurred once in the treated group and 5 times in the untreated group, with 1 intracranial hemorrhage in this latter group. The total number of deaths during the period of observation was 3 in the untreated group and none in the treated. In the second group consisting of 160 patients there were 9 vascular accidents with 5 deaths in those treated and 10 vascular accidents, all fatal, in those not treated. In the third group 11 vascular accidents with 10 deaths occurred in those treated; 12 vascular accidents, all fatal, occurred in those not treated.

The author concludes that "the absence of thyroid substance in an organism plays an important role in the degeneration associated with arteriosclerosis." He logically admits, however, that other factors besides thyroid deficiency will produce the same type of degeneration, and that in the older group studied, thyroid did not appear to offer the same degree of protection as reflected in the younger groups. The younger groups appeared better protected from at least two manifestations of vascular degeneration associated with arteriosclerosis when given thyroid. Predicated on this observation the author based the indication for necessary study to establish the need for thyroid medication, as he believes the administration of the substance, in this age group "may be of importance in the protection of the vascular tree." In his concluding paragraph the author emphasized that "the evidence \*\*\* indicates that hypofunction of the thyroid gland produces a degenerative change in the walls of the larger vessels," but that it is not the sole factor and that "other processes, particularly nutritional, may produce similar changes in the wall of blood vessels and result in arteriosclerosis."

This monograph is well documented by up-to-date references and illustrated by graphs, tables, and photomicrographs. This publication will prove of interest to any one interested in the cause of arteriosclerosis.—Col. C. R. Mueller, MC, U. S. A.

*Modern Medication of the Ear, Nose and Throat*, by Noah D. Fabricant, M. D., M. S., Clinical Assistant Professor of Otolaryngology, University of Illinois, College of Medicine, Chicago, Ill. Foreword by Austin Smith, M. D., Editor, *The Journal of the American Medical Association*, 243 pages; illustrated. Grune & Stratton, New York, N. Y., publisher, 1951. Price \$5.75.

The author states that this book is intended to meet the day-by-day requirements of physicians interested in the practical applications of medications of the ear, nose, and throat. This objective has been attained admirably. The author has clearly and concisely summarized the basic anatomy, physiology, and bacteriology of each area under consideration. This is followed by a brief discussion of the pharmacologic principles involved and, finally, a discussion of the method of treatment of specific pathologic conditions of the ear, nose, and throat. At the end of each chapter a very good bibliography is presented. In his preface the author states "In an era of uncontrolled usage of antibiotics there is greater need than ever for intelligent therapeutics." Dr. Fabricant has succeeded in presenting a usable volume of intelligent everyday therapeutics and this volume will be of value to the physician who must treat the more common conditions of the ear, nose, and throat.—Commander W. B. Larkin, MC, U. S. N.

# The Psychiatric Consultation

Warren J. Barker, Lieutenant Colonel, U. S. A. (M)

**T**HIS article is the result of a review of 27 consecutive consultation reports made at this teaching general hospital. These reports represented the work of 14 psychiatrists over a period of about 2 months. Although the written material on these reports did not lend itself to a valid statistical study, the review served to bring into focus a number of points which seem worthy of consideration and comment. Kohut (2), Cushing (3), and Watters (4) have written of the problems encountered in the referral situation in private practice, clinics, and hospitals. The aim of this article, too, is to discuss some of the dynamic interpersonal factors existing and uniting between and among the patient, referring physician, and psychiatrist in the framework of the referral operation. Some of these factors, particularly the unconscious, sometimes irrational attitudes of the persons involved, are hardly ever exposed to view, yet their recognition and appropriate handling by at least the referring physician and psychiatrist can be of momentous significance in contributing to the success of the consultation.

Meaningful communication between 2 persons, resulting in mutually satisfactory and useful common understanding on any subject, no matter how seemingly neutral and impersonal, is at best a complicated, ill-understood, often laborious, process. When the subject under consideration is a person in distress the complexities appear to be enormously compounded. These generalizations lead us directly to the communication problem which confronts the referring physician, first in broaching the matter of referral to his patient, and second in making his referral request to the psychiatrist. The latter, in turn, will find his capacity for listening and understanding taxed in his interview with the patient and later his capacity for expression will be taxed in making his report to the referring physician. The opportunities for misunderstanding are

(1) Walter Reed Army Hospital, Washington, D. C.

(2) Kohut, H. (Chicago): *Psychiatric consultations in a general hospital*. Read at post-graduate conference in neuropsychiatry, Dixon State Hospital, Dixon, Ill., March 31, 1949.

(3) Cushing, J. G. N.: *Role of psychiatrist as consultant*. Am. J. Psychiat. 106: 861-864, May 1950.

(4) Watters, T. A.: *Certain pitfalls and perils in psychiatric referral*. Read at annual meeting of the American Psychiatric Association, Cincinnati, Ohio, May 8, 1951.

increased when in the next scene the referring physician attempts to communicate to the patient the psychiatrist's opinions and recommendations in a therapeutically effective way.

I have hinted at some of the complexities inherent in interpersonal communication, nonverbal as well as verbal, and of significant contributing attitudes, unconscious as well as unconscious, rational as well as irrational, likely to be held by the 3 principals in the psychiatric referral. Let us consider some of these in more detail without presuming that thereby we will arrive at a simple, effortless, automatic system of referral. Rather, we will need to content ourselves with a few suggestions which both the referring physician and the psychiatrist may try in his own practice and confirm, modify, or reject.

### THE REFERRAL

How can the patient be so prepared for psychiatric consultation that the chances of it being most meaningful are enhanced? It is safe to say that no matter what his expressed attitude may be, every patient will feel threatened to some degree by the prospect of being seen by a psychiatrist. The better the existing relationship between the doctor and the patient, the easier referral will be.

The attitude of the referring physician himself is of crucial importance. Physicians, like other human beings, have erected over the course of a lifetime more or less subtle and effective defenses against the emergence of disturbing, unwanted impulses from the unconscious mind, that subterranean reservoir of still active infantile wishes and fears. If these unwanted impulses approach awareness, anxiety—the painful warning signal—is generated. Various defensive attitudes against accepting the fact that emotional factors operate in himself or others—including hostility, contempt, denial, or even overestimation in respect to them—may be present and are likely to be communicated to the patient even before the matter of referral is actually broached. One can be sure that most patients are sensitive enough to discern the real attitude of others whether it is explicitly spelled out or not. So, when confronted with a patient who manifests poorly disguised instinctual tendencies and drives, or one who, in attempting to defend himself against them, is inappropriately helpless, demanding, ingratiating, or seductive, the referring physician's own defenses may be so threatened that the whole issue of dealing realistically and objectively with the patient becomes contaminated with his own emerging anxiety. Under these circumstances the referral may serve the referring physician as a riddance device, or become a plea for the psychiatrist to do something about the patient rather than something for him. It is apparent that unless the psychiatrist too has a good understanding of his own personality and has learned to deal effectively with his own unconscious he will fail to be objective and realistic and the patient's problems will not be understood or dealt with properly.

The patient may voice any of a variety of objections, usually rationalizations of anxiety, in order to avoid psychiatric consultation. The extent to which the referring physician reacts to these objections either by acquiescence, overzealous argument, or with realistic understanding, is of critical importance in regard to future developments in the case. Not infrequently then, and sometimes with reason, the patient may interpret the referral as a rejection by his physician, feeling that his physician thinks that he is "crazy," therefore unworthy. His reaction is likely to be one of anger, resentment, and defiance, no matter how well he disguises it.

Every person in distress seems to have a tendency to expect the worst and the best at the same time. Parallel to the attitude of fear and reactive hostility often entertained toward the psychiatrist there is usually a coexistent, covert attitude of awe, . . . the psychiatrist is one possessed of mysterious and secret power. . . . It may have benevolent aims if the patient is compliant, i. e., "good." Every physician, whether he be a psychiatrist or not, is a parent surrogate to the "child" in his patient. This is a role he cannot avoid even if he does not tamper himself in it. The wise psychiatrist will understand both inappropriate hostility toward him and overestimation of him—expressions of infantile attitudes toward the parents—in the light of their defensive function, and will try to use them therapeutically. Both these attitudes are faces on the same coin and while only one may be visible, the other is nevertheless present. Although the propensity to hope for a magical relief from discomfort is latent in every patient, both the referring physician and the psychiatrist, no matter how well-meaning the motive, should be on guard against overselling the patient on the benefits to be expected as a consequence of the referral. There is another danger which may get the referral off to a poor start; this is the practice of referring to the psychiatrist with such euphemistic designations as "neurologist" or "nerve specialist." This device not only reflects the physician's anxiety but serves to reinforce the patient's need to believe that his illness is "organic" and has no connection with his inner, personal self or his intimate feelings toward significant people in his life.

Many of these difficulties inherent in the referral situation can be minimized if patiently, in good faith, and with a sincere wish to help the patient, the physician will discuss with him the reasons for referral. This discussion with an approach both cordial and frank can well begin with some general statements about the interrelatedness of emotions and physical sensations with specific examples within the realm of common experience such as reactions to fear or rage. This can be followed by explaining how in an analogous manner some of the patient's symptoms may have a similar origin and that the psychiatrist is one who makes a special study of such phenomena. Each physician will have his own technic in recommending referral and this will of necessity

Naturally there is wide variation in the complexity and seriousness both of the underlying emotional conflict and the symptomatic manifestations of it. There are variations among different patients and variations in the same patient from time to time, and in differing emotional climates. Some symptoms are comparable in their discomfort to the pain attending the passage of a kidney stone, others to the annoyance of psoriasis. Some conflicts are comparable in their prognostic implications to cancer, others to chickenpox.

Not all patients can accept help from a psychiatrist. Fortunately not all those seen by him need his help. The psychiatrist can only evaluate the patient as realistically as his capacity will permit and then do the best he can with the resources available. The limitations of time alone make it impossible for the psychiatrist himself to treat every patient who is referred to him. If he attempts to do so only out of a sense of obligation to the referring physician or to his own conscience, or because he becomes sympathetically overidentified with the patient—all earmarks of the psychiatrist's own anxiety—he will soon find his energies dissipated and his effectiveness reduced to the point where he is of little real service to anyone. A great deal of misunderstanding and recrimination can be avoided if the psychiatrist will not promise more than he can accomplish. At the same time, he must be on guard against turning a patient away solely because the latter's problems are too close to those with which the psychiatrist himself is struggling in his own unconscious.

Among the therapeutic possibilities, long-term, intensive psychotherapy—psychoanalytic or quasi-psychanalytic—which aims at the resolution of the underlying conflicts which give rise to symptoms is the most scientific, but, because of the time involved, as well as the inapplicability of the method to many types of patient, it is not often practical to undertake such treatment in the military setting. Even the psychiatrist whose special training qualifies him in psychoanalysis cannot, in addition to his other duties, work effectively with more than a few patients at a time in a thorough-going "uncovering" therapy. Brief psychotherapy and various supportive measures with limited therapeutic goals must often be the treatment of choice. This is not to imply that this kind of treatment is by nature more simple or less demanding of thorough and sound psychiatric consideration. In supportive therapy the psychiatrist has to know what defenses he is trying to strengthen and reinforce. This is possible only if he has a sound understanding of psychodynamics—his own as well as the patient's (6). Sometimes, in relatively few interviews the patient who is not so seriously incapacitated can be effectively helped or at least reconciled to minor discomfort.

A fact which can hardly be over-emphasized is that in many cases where good rapport exists and there is willingness and understanding,

(6) Stone, L. Psychoanalysis and brief psychotherapy. *J Psychoanal. Quart.* 22: 215-234, Apr 1951.

the referring physician himself may be the best source of help for the patient. When indicated and desired, the psychiatrist may act as supervisor of such therapy without any direct participation in the relationship between doctor and patient. The importance of this therapeutic avenue has been stressed by Cushing (3) and is in keeping with the spirit of SGO Circular No. 64 (7).

Even if somewhat precocious, scientific psychiatry is young and can hardly claim an exclusive formula for assuring universal social harmony and individual happiness. In some instances manipulation of the environment will make it possible for the patient to make a better adjustment. For the patient in whom alcohol has become a serious personal and social problem, there should be no reluctance in recommending recourse to Alcoholics Anonymous. Other patients may find succor in religion or a "cause" of one kind or another.

### THE CONSULTANT'S REPORT

As to the psychiatrist's written consultation report, it should begin with a statement of the patient's age, sex, and other identifying data. There should follow a recapitulation of the complaints and present illness. In addition there should be a description of the patient's mental status, and enough of the patient's history to show the main outline of his personality development in order to bring out the relationship, if significant, between his present illness and his habitual ways of reacting to people and to the vicissitudes of life. Certainly there should be comment on the original questions raised by the referring physician whether they proved to be vital or not. Peterson (8) has written of the special material which needs to be covered in the various reports requested for administrative reasons.

Psychodynamic considerations stated in straightforward and clear terms cannot fail to give the referring physician a better understanding of the patient and at the same time furnish a basis for understanding the rationale behind the psychiatrist's recommendations. The military psychiatrist must, however, bear in mind that his report, in the case of military patients, may be read before a Physical Evaluation Board, and in some instances may be made available to the patient's family, or even the patient himself, as provided by the law and regulations governing retirement for disability. Therefore it is probably wise to omit a discussion of those unconscious dynamic factors having to do with certain unacceptable (ego-alien) impulses when the report is likely to become, even in a limited sense, public. Assuming that formulations at this psychodynamic level are valid, they are nevertheless likely to be both disturbing and uninstructive to any but another psychiatrist.

(7) Office of The Surgeon General, U. S. Army: Postgraduate Short Courses for Medical Corps Officers at Military Installations, part II 42, SGO Circular No. 64, Apr. 25, 1951.

(8) Peterson, D. B.: Boards, certificates, and psychiatric reports. U. S. Armed Forces M. J. 2: 959-970, June 1951.

Industrial applications are treated separately. A final chapter, placed as an appendix, contains a technical development of the diffractive theory of phase microscopy with Kohler illumination and will be useful to the physicist or microscopist concerned with phase difference optics *per se*. The book has an excellent bibliography and is attractively printed on good paper. It will prove a useful textbook not only in laboratories where phase microscopy is practiced, but also where electron magnification methods are employed.—J. Warren, *Pb. D.*

The 1951 Year Book of Pediatrics (July 1950-June 1951), edited by Henry G. Poncher, M. D., Professor and Head, Department of Pediatrics, College of Medicine, University of Illinois, with the collaboration of Julius E. Richmond, M. D., Professor, Department of Pediatrics, College of Medicine, University of Illinois, and Isaac A. Abt, M. D., Editor Emeritus. 411 pages; illustrated. The Year Book Publishers, Inc., Chicago, Ill. 1951. Price \$5.

This book abstracts and reviews the pertinent pediatric literature which appeared during the last half of 1950 and the first half of 1951. The editors have made an excellent choice in the material selected for abstracting from the world-wide literature on pediatrics which has become enormous. The comments of the editors after many of the abstracts are pithy and provocative. The opening editorial highlighting the general trends in pediatrics is a succinct review of the present direction of pediatric thought and research. The introductory editorials for specific chapters are a valuable part of this book, because they are concise critical reviews of the latest advances and trends in the many fields concerned with pediatrics. The senior editor has stated that his policy is to provide concise, authoritative, up-to-date information which will be significantly useful to the practitioner. A perusal of this book will convince the reader that this policy has been carefully adhered to.

—Commander T. E. Cone, Jr., MC, U. S. N.

Surgery of the Stomach and Duodenum, by Claude E. Welch, M. D. Associate Visiting Surgeon, Massachusetts General Hospital; Clinical Associate in Surgery, Harvard Medical School. 349 pages; illustrated by Mundel McLatchie Miller. The Year Book Publishers, Inc., Chicago, Ill. publisher, 1951. Price \$8.50.

To the surgical resident and the surgical practitioner who operate on the upper gastrointestinal tract but occasionally, this textbook of operative surgery will be most profitable. The book deals chiefly with technical maneuvers, all of which are illustrated by excellent drawings. All surgeons will be interested in the sections dealing with the difficult duodenal stump and the complications of gastric resection. Various well-qualified surgeons will differ with the author on some of his recommendations, but Dr. Welch points out in his preface that the recommended operations are those currently in use in the Massachusetts General Hospital. This volume is to be one in a series which should be a worthy addition to any surgeon's library.

—Commander I. J. Timmer, MC, U. S. N.

# Multiple Laceration of the Auricle

George M. Cazan, Jr., Lieutenant Commander, MC, U. S. N. R. (Inactive)

FOR ages wounds of the pericardium and its contents were considered fatal. This belief prevailed until the latter part of the eighteenth century. Healed cicatrices in the hearts of persons with known previous precordial chest wounds were observed repeatedly at autopsy. This caused a few eighteenth century surgeons to take a skeptical attitude toward the prevailing belief. Ambroise Paré was one of the first to cite numerous instances of soldiers who survived hours after sustaining penetrating wounds of the heart, as later proved at autopsy. Other patients with cardiac wounds were being reported as living several days after injury.

Despite efforts to dispel the belief that all cardiac wounds were necessarily fatal, any attempt to enter the pericardial cavity was condemned by the medical profession. In 1826 an heir to the French throne (Duc de Berry) was stabbed in the heart by an assassin. Dupuytren, his surgeon, was severely reprimanded after keeping him alive several hours by relieving the tamponade with a probe periodically introduced into the wound. Today, pericardial decompression is not only a frequent pre- and a post-operative necessity but is advocated as a definitive therapeutic procedure. Paré predicted that some day suture of the human heart would be successfully accomplished. It was not until 1895, after Del Vecho successfully sutured the heart in a series of dogs, that the procedure was attempted on a human being. This attempt was unsuccessful but in 1896, Rehn reported the first successful suture of the human heart. Similar pioneering efforts quickly followed.

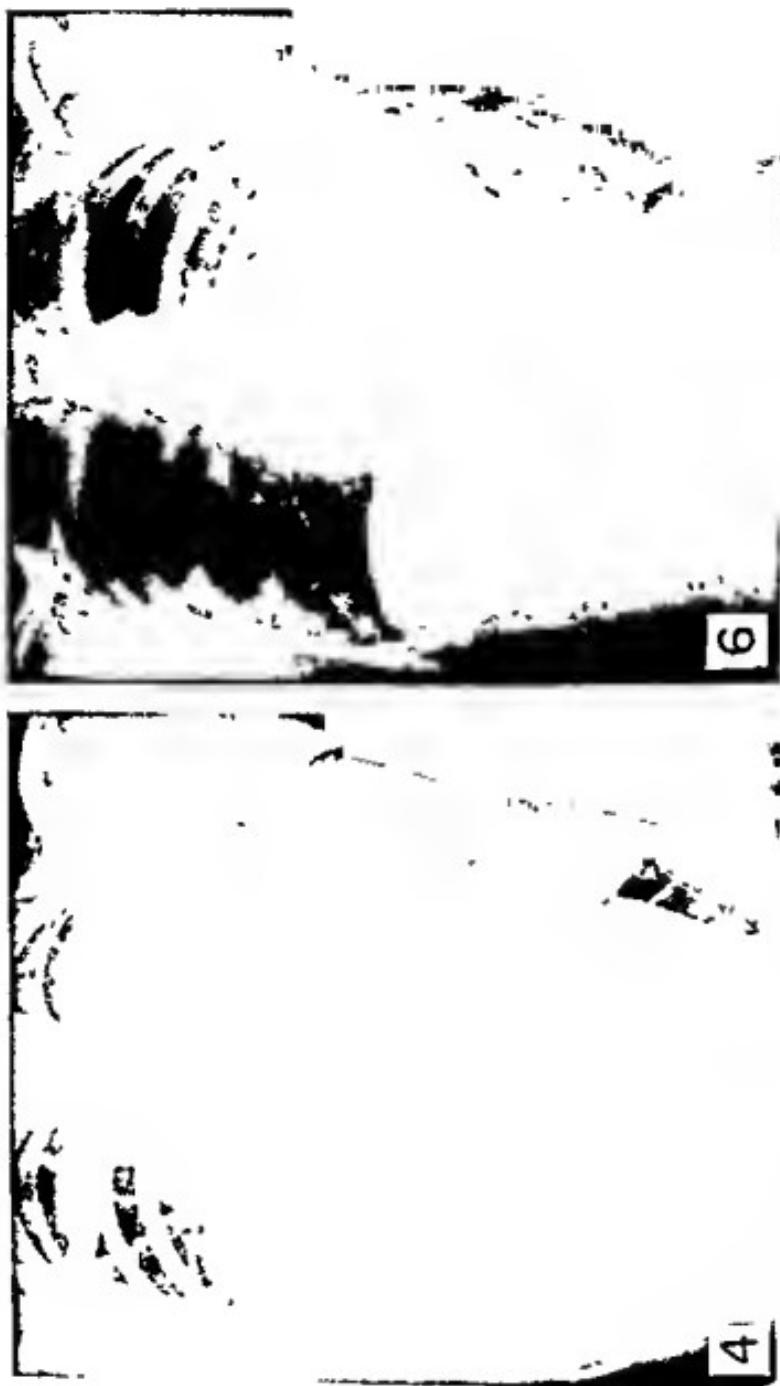
## INCIDENCE

Elkin (1) in 1938 and Bigger (2) in 1939 reported a 50 percent mortality from this operation in the United States. Subsequently, Bigger

(1) Elkin, D. C.: Diagnosis and treatment of wounds of heart; review of 22 cases. J. A. M. A. 111: 1750-1753, Nov. 5, 1938.

(2) Bigger, I. A.: Heart wounds; report of 17 patients operated upon in Medical College of Virginia hospitals and discussion of treatment and prognosis. J. Thoracic Surg. 8: 239-253, Feb. 1939.

*Figure 4. Roentgenogram of the chest taken 36 hours after operation. Figure 6. Roentgenogram of the chest taken 24 hours after that shown in figure 4.*



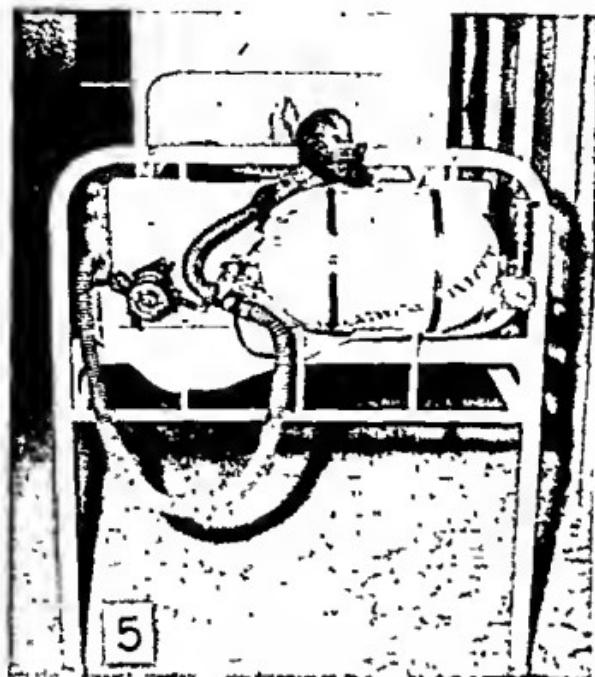


Figure 5. Pressure demand oxygen regulator and high altitude mask.

blunting of the left costophrenic angle. EKG's revealed no evidence of myocardial damage. Shifting of the S-T segments were noted and interpreted as probably due to a healed pericarditis. It was believed that the patient's symptoms were probably due to a paradoxical motion of the soft tissues overlying the surgical absence of the costal cartilages on the anterior chest wall and adhesion of the pericardium to the parietal pleura. It was recommended that an external protective device be worn at all times. Psychologic factors undoubtedly played some part in producing this man's symptoms. He had no significant disability.

#### DISCUSSION

The physiopathology and management of penetrating wounds of the heart have been extensively described by Beck (6), Bigger (2,3,7), Elkin (1,8,9), Maguire and Griswold (4,5), and others. The immediate causes of death in these injuries have been attributed to (1) internal or external exsanguination, (2) involvement of a major coronary vessel,

(6) Beck, C. S., and Cox, W. V.: Effect of pericardiotomy on mechanics of circulation. Arch. Surg. 21: 1023-1039, Dec. (pt. 2) 1930.

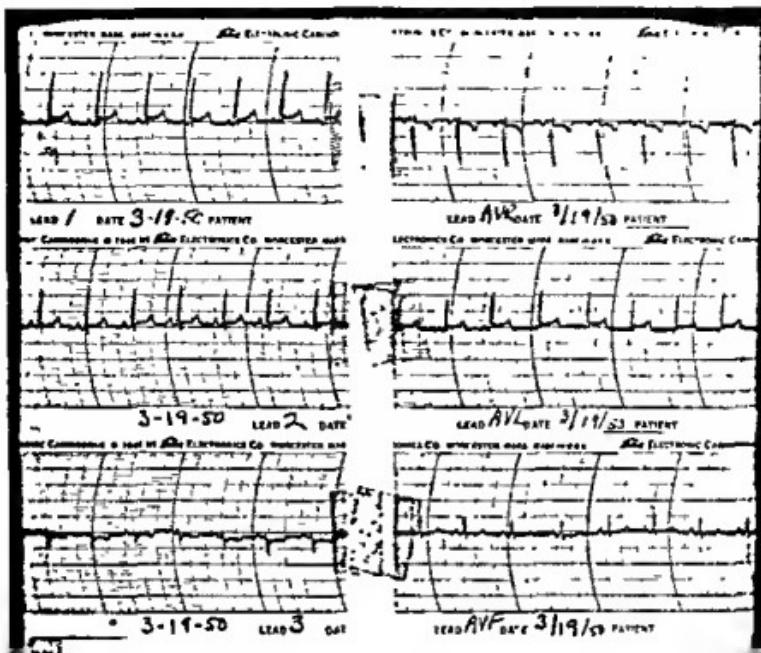
(7) Bigger, I. A.: Wounds of heart and pericardium; report of cases and summary of literature of sutured heart wounds. South. M. J. 25: 785-794, Aug. 1932.

(8) Elkin, D. C.: Emergency surgery of heart. Am. J. Surg. 46: 551-561, Dec. 1939.

(9) Elkin, D. C.: Suturing wounds of heart. Ann. Surg. 95: 573-577, Apr. 1932.



Figure 7. Roentgenogram taken 1 hour after that shown in Figure 6. Figure 8. Roentgenogram taken on twelve<sup>th</sup> postoperative day.



*Figure 9. ECG's made on the day of operation.*



Figure 10. Roentgenogram taken on the forty-ninth postoperative day.

and (3) tamponade. Death is usually rapid with exsanguination and coronary vessel injury and these patients do not generally present themselves for surgical intervention. Tamponade, on the other hand, can develop rapidly or gradually depending on the location and type of wound and size of the pericardial rent. The diagnosis is not difficult. There is a chest wound, shock, and a slow and quiet heart despite a falling systolic and a rising diastolic pressure. Elkin stated that he relies on distention of the neck vessels more than anything else as an indication of tamponade. If time permits, venous pressure readings will show an elevation corresponding to the degree of tamponade. Maguire and Griswold state that rapidly forming tamponade may occur with the escape of as little as 200 cc. of blood. My patient presented a penetrating wound of the heart with two openings into the left auricle. Death would have ensued without surgical interference. There was no involvement of a coronary vessel and no exsanguination. At the same time, such findings of tamponade as elevated diastolic and venous pressure and distention of the neck vessels were lacking. This was accounted for at the time of operation by the fact that only about 75 cc of blood was found within the pericardial cavity.

What then, was the mechanism that led to cardiac arrest in this patient? I believe that the following sequence of events transpired. The extensive openings in the auricle allowed blood to escape into the pericardial cavity more readily than into the left ventricle. Ventricular filling failed because of the shunting effect through the auricular wounds. The contractions of the heart brought almost no blood to the intracardiac circulation and a primary decrease in cardiac output resulted. Anoxia of the heart muscle developed. The absence of blood delivery to the right side prevented tamponade and its embarrassing effects from developing.

Another interesting physiologic mechanism demonstrated in this case was the effectiveness of positive pressure breathing in a patient with pulmonary edema due to cardiac decompensation. The results in this patient were dramatic clinically and roentgenographically. It is doubtful that digitalis alone could have produced such a rapid response.

A third feature of this case was the successful repair and healing that was effected without the use of special clamps and without the use of anticoagulants. Because of the friability of the auricular walls, the principal difficulty encountered in repair of these wounds is hemorrhage and mural thrombosis with secondary emboli. No difficulty was experienced in suturing this patient's heart without clamps and without the use of anticoagulants. The horizontal mattress sutures of fine black silk minimized the tendency for bleeding along the everted suture line and also prevented exposure of the suture material within the endothelial cavity of the heart. Mural thrombi were thus avoided.

# Medical Service in the Air Defense Command

Arthur J. Donneson, Major, U. S. A. F. (MSC)

THE primary mission of the Air Defense Command of the United States Air Force is the development of sufficient forces to protect the continental United States against enemy air attack. The great importance of this responsibility for the security of our Nation is believed to justify this brief report on the medical service of this Command which, since January 1951, has held the status of a major Air Force command. Under the Air Defense Command the United States is divided into 3 air defense forces, each of which is further subdivided into air divisions. These are designed to control the air-raid warning systems, and to exercise command over all air defense activities during an alert or attack, including the operational control of the fighter wings.

The conduct of the medical service in the Air Defense Command presents a wide range of problems covering medical care in installations from large, well-equipped, fully staffed hospitals to isolated, one-room dispensaries located 40 or 50 miles from the nearest community and operated by a single airman. Since June 1950, when the Korean conflict started, there has been a constant and impressive expansion of facilities in connection with the increased importance of the air defense mission. With the establishment of each new base or separate activity, medical service has to be provided. Critical shortages of all categories of Medical Service personnel and lack of experience on the part of those available led to problems and difficulties. In many instances young medical officers with little or no prior military experience found themselves assigned as base surgeons, responsible for establishing and operating hospitals and infirmaries. Assistance was given them by the air surgeons of the 3 air defense forces, Headquarters, Air Defense Command, Colorado Springs, Colo., and medical depot liaison officers who offered guidance in obtaining adequate supplies, installing x-ray and other technical equipment and establishing proper supply accounts.

As additional officer and airman personnel became available, an intensive on-the-job training program was instituted, in addition to the

placement of many airmen in medical service schools. Cadres were established at each hospital in the Command and were trained so that they could be reassigned to new bases to establish the medical service. Trained airmen set up pharmacies, laboratories, and x-ray services. Flight surgeons' offices, out-patient clinics, wards, messes, and administrative activities were rapidly and efficiently established when required where adequate buildings were available; otherwise local arrangements were made for medical attendance at nearby military, other government, or civilian medical activities. The value of trained cadres during any projected expansion period cannot be over-emphasized.

One of the most difficult problems associated with the Command medical service was that imposed under the Aircraft Control and Warning Program. For thousands of miles along the borders of the United States there lies an integrated net of radar warning stations. Each is a complete, modern installation with highly trained personnel assigned to operate the radar and communications equipment as well as for the usual administrative functions. Under the air defense forces, specified geographic areas are placed under the jurisdiction of various air divisions. The divisions control certain aircraft control and warning groups, which, in turn, administer the squadrons operating the sites. As it is usually uneconomical and undesirable to keep a full-time physician or dentist at an aircraft control and warning squadron, these officers are assigned at group or division level, but are responsible for proper medical service at the aircraft control and warning sites.

In order to maintain an integrated radar network, many sites are located in relatively isolated areas at great distances from even small communities. An unpaved road is often the only means of access aside from use of a helicopter. Mosquito control and water supply present a recurrent problem at some installations. At practically all isolated sites, primary medical care is furnished by an airman medical service supervisor who is qualified by training and experience for such duty. Whenever possible, the services of a part-time civilian physician are used. The evacuation of patients from isolated sites is tedious and difficult. Currently a jeep is authorized and used, but a recommendation has been made that it be replaced by one of the standard field ambulances, which are now being furnished to all sites as rapidly as possible.

During the winter months some aircraft control and warning sites are snowbound for varying periods and evacuation of patients by helicopter is occasionally necessary. Recommendations have been made for the permanent assignment of helicopters to certain air divisions in order to evacuate patients and obtain supplies under emergency conditions. Pending approval, the Air Sea Rescue Service and other agencies having helicopters are furnishing support wherever possible.

Dental service also poses a problem at the aircraft control and warning sites. Isolated installations are supported by "circuit riding" dental

officers using a Dental Chest No. 60. At the far northern sites, dental care must be given during the late spring, summer, and early fall because the roads are often impassable at other times.

Early in 1950, a study indicated that the equipment in Dental Chest No. 60 was not adequate, and that the installation of a one-chair clinic for the visiting dental officer warranted consideration. It was decided that the cost of these clinics would be prohibitive, and that a number of mobile clinics would be more practical and more economical. After studying the designs and specifications of numerous mobile units built for use by the United Nations, foreign governments, and various private agencies, a completely new mobile clinic was designed with the assistance of the Armed Services Medical Procurement Agency. This vehicle, hauled by a prime mover, incorporates the best features of all the designs studied. It is a two-chair clinic, including x-ray equipment and a small but complete dental laboratory. Two standard instrument cabinets, plus many built-in cabinets, provide sufficient storage space for a 3-month level of dental supplies. The vehicle is air-conditioned and is supplied with power and air for the dental units by means of an installed gasoline generator and compressor.

Eleven of these dental trailers are currently being manufactured. Manned by two dental officers, a dental laboratory technician, and a dental assistant, each will visit aircraft control and warning sites, remaining long enough to provide dental care for the assigned personnel. Prosthetic appliances will be made and fitted before departure of the mobile clinic for the next site. Designated parent bases will replenish supplies in the same manner as for the dispensaries operated at the sites.

At Headquarters, Air Defense Command, as well as at the three air defense force headquarters, constant and careful studies are being made by the air surgeons and their staffs covering all phases of medical activity in the command. Staff officers make frequent visits to the medical facilities to determine the adequacy of personnel and equipment, and to discuss special problems. Close coordination with officers in charge of construction at all echelons is maintained and has resulted in an improved building rehabilitation program and much new construction. The problems of dependent care are given particular attention, and wherever possible, medical personnel and facilities are made available within the limitations imposed by the military workload. Recommendations from all personnel are encouraged and are given careful consideration. Expansion of medical facilities in the Air Defense Command has kept pace with the rapid expansion of other activities in the Command. The medical service will continue to provide the support required under any new expansion program as long as the principles of economy in the use of available manpower, judicious planning, and adequate training are adhered to. Under such policies there should be constant improvement in the medical service.

## BOOK REVIEW

**Chronic Disease and Psychological Invalidism, A Psychosomatic Study,** by *Jürgen Ruesch, M. D., in collaboration with Robert E. Harris, Ph. D.; Carole Christiansen, M. A.; Susanne H. Heller, B. A.; Martin B. Loeb, B. A.; Salley Dewees, M. S.; and Annemarie Jacobson, M. D.* Foreword by *Karl M. Bowman, M. D.* 191 pages. University of California Press, Berkeley, Calif., Publishers, 1951. Price \$3.50.

"Modern psychiatry needs the integration of descriptive psychiatry, psychometrics, and psychodynamic theory." Toward that end, Dr. Ruesch and his colleagues at the Langley Porter Clinic and at the University of California Medical School have made an important contribution to psychosomatic medicine through their study of chronic illness and delayed recovery. This book is a report of that study, conducted on patients with physical symptoms which had persisted for an undue time beyond that which they could reasonably have been expected to improve.

Two groups of patients were included in the study. In the first group, 123 patients from the outpatient clinic were each subjected to an intensive study, lasting about 3 hours, including a physical work-up, diagnostic psychiatric interview, psychologic tests, personality inventory and social and cultural classification by an arbitrary standard. These results were statistically analyzed. Sixty-four inpatients in a second group were studied intensively for from 10 to 15 hours each within the framework of dynamically oriented individual and group psychotherapy. From the study and evaluation of these data, the authors were able to show clearly the operation of psychosomatic mechanisms in 78 percent of the patients studied, the delayed recovery being the patient's method of avoiding a conflict. The book includes extensive discussion of this avoidance mechanism and includes case material for illustration. The situational, social, and cultural factors are included in the psychosomatic formulation of delayed recovery. The authors used rather active and aggressive short-term psychoanalytically oriented psychotherapy in the rehabilitation of these delayed recoveries. When that method failed, they recommended psychoanalysis.

This study should prove interesting, inspiring, and instructive to the entire medical profession. It should be of particular value to the medical officers of the Armed Forces.

—*Lt. Col. R. E. Switzer, MC, U. S. N.*

# Combined Streptomycin-Tuberculin Therapy in Pulmonary Tuberculosis<sup>(1)</sup>

## Methods of Treatment

Eugene C. Jacobs, Colonel, MC, U. S. A.

Joseph R. Vivas, Lieutenant Colonel, MC, U. S. A.

*"No one can enthusiastically and hopefully treat a chronic disease unless he is convinced that the methods used are producing encouraging results." (2)*

Believing that the combined streptomycin-tuberculin therapy has already produced encouraging results in the management of pulmonary tuberculosis, we enthusiastically and hopefully present the methods which we have used. The barrier which interferes with the action of streptomycin on the tubercle bacilli within tuberculous lesions (3-6) is primarily the avascularity of these lesions and is caused by thrombosis (7) and endarteritis obliterans of the vessels (8,9) within the lesions and the fibrous encapsulation about them. Efforts have been made to penetrate this barrier by combining other agents with streptomycin, namely: potassium iodide (10), streptokinase (11), and tuberculin (12-14). Maurer (4) has used cavernostomy to drain cavities and to insert a

(1) This work was done at the Walter Reed Army Hospital, Washington, D. C.

(2) Joslin, E. P.: Treatment of diabetes today. J. A. M. A. 140: 581-585, June 18, 1949.

(3) Morin, J.: Streptomycin therapy. Acta tuberc. belg. 40: 48, 1949.

(4) Maurer, G.: Cavernostomy and tamponade of pulmonary cavities with para-aminosalicylic acid. Dis. of Chest 16: 676-683, Dec. 1949.

(5) Shamaskin, A.; Des Autels, E. J.; Sweany, H. C.; and Zvetina, J. R.: Streptomycin in treatment of military and meningeal tuberculosis based on study of 30 cases. Dis. of Chest 16: 765-790, Dec. 1949.

(6) Vivas, J. R., and Jacobs, E. C.: Combined streptomycin-tuberculin therapy in pulmonary tuberculosis. Bull. U. S. Army M. Dept. 9: 1-9, Jan. 1949.

(7) Savatool, J. W., and Chart, R.: Thrombosis of pulmonary artery. Am. Rev. Tuberc. 44: 42-57, July 1941.

(8) Denst, J.; Hurst, A.; and Dressler, S. H.: Histologic study of blood vessels in surgical resected tuberculous lungs. Am. Rev. Tuberc. 64: 489-498, 1951.

(9) Jacobs, E. C., and Kubas, D. M.: Avascularity of tuberculous lesions; major problem in therapy. To be published.

(10) Woody, E., Jr.; Johnson, H. E.; Avery, R. C.; and Crowe, R. R.: Combined effect of potassium iodide and streptomycin on far-advanced pulmonary tuberculosis. Dis. of Chest 19: 373-386, Apr. 1951.

therapeutic agent directly within them. In this article we will consider the use of tuberculin in combination with streptomycin in the treatment of pulmonary tuberculosis.

### SELECTION OF PATIENTS

Because accurate data concerning a specific therapy can only be obtained when patients whose diagnosis has been proved bacteriologically are treated, positive smears and cultures are required of all those who are to be treated with combined streptomycin-tuberculin. Although the recovery of the specific micro-organism is presently the only requirement for this treatment, because of certain events in the early history of tuberculin therapy (15), close supervision is recommended in the administration of tuberculin, especially when pulmonary tuberculosis is complicated by extreme toxicity, hemoptysis, or pleural effusion.

It would seem to be superfluous to inject tuberculin into a patient already overwhelmed by the products of the tubercle bacillus, yet several extremely toxic patients in our series have made dramatic recoveries following tuberculin therapy.

It would appear likely that hemoptysis might be increased by tuberculin therapy because tuberculin tends to increase the vascularity about the tubercles and the permeability of the vessels. Although caution is recommended in the use of tuberculin therapy in the presence of hemorrhage, the combined therapy has been used in 3 patients with acute hemorrhage with quick cessation of bleeding in each case. This number is too small to warrant any general conclusions.

It would also seem likely that tuberculin might increase pleural effusion since older phthisiologists have accused it of causing effusion. It was therefore our policy not to administer tuberculin in the presence of pleural effusion, but in treating patients with pulmonary tuberculosis, it was noted that several small effusions disappeared promptly during therapy. One patient with positive sputum and a large pleural effusion was admitted to the hospital. To make reasonably sure that his effusion would not disappear spontaneously, his chest was tapped on several occasions; it quickly refilled with fluid each time. Combined therapy was administered to this patient after a return of the fluid following one of these aspirations. During treatment the effusion disappeared quickly and completely and had not recurred after 1 year of observation. No general conclusions can be drawn from this single case.

(11) Cathie, I. A. P. Streptomycin-streptokinase treatment of tuberculous meningitis. *Lancet* 256: 441-442, Mar. 12, 1949.

(12) Cavaoura, C. Results of treatment of tuberculous meningitis in infants and children with streptomycin. *Pédiatre* 37: 543-552, 1948.

(13) Cairns, H., Smith, H. V., and Vollum, R. L. Tuberculous meningitis. *J. A. M. A.* 144: 92-96, Sept. 9, 1950.

(14) Jacobs, E. C., and Vriss, J. R. Combined streptomycin-tuberculin therapy in pulmonary tuberculosis, pilot study. *U. S. Armed Forces M. J.* 3: 115-123, Jan. 1952.

(15) Virchow, R. Über die Wirkung des Koch'schen Murella auf innere Organe Tuberkulöser. *Berl. klin. Wochschr.* 28: 49-54, 1891.

Tuberculous meningitis and miliary tuberculosis are complications which have been treated successfully by the combined therapy. Cavaoura (12) and Cairns et al. (13), by giving tuberculin intrathecally daily or every second day in conjunction with streptomycin intrathecally and intramuscularly daily, have obtained the most encouraging results yet reported in the treatment of tuberculous meningitis. They have also had success with miliary tuberculosis, both alone and complicated with tuberculous meningitis.

#### METHOD OF STUDY

After a patient with pulmonary tuberculosis has been accepted for treatment, it is necessary to establish a base line by making certain tests before beginning specific therapy. Also during and following treatment, it is necessary to make further tests in order to determine the patient's progress and prognosis as well as to evaluate the efficacy of the therapy.

##### *Studies prior to therapy:*

Tuberculin test (first and second strength).

Roentgenograms of the chest (posteroanterior routinely; lateral, lordotic, oblique, tomograms, stereoscopic, et cetera when indicated).

Streptomycin sensitivity determinations.

Sedimentation rate (16).

Complete blood count.

Urinalysis.

Weight (16).

Photograph of patient with minimum of clothing.

Temperature and pulse (16).

Caloric test (performed by ear, nose, and throat department).

Physical examination.

##### *Studies during therapy:*

Daily: Temperature, respiration, and pulse at 0700 and 1900 hours (often if indicated).

Weekly: Sedimentation rate, complete blood count, urinalysis, and weight.

Every 10 days: Roentgenogram of chest (posteroanterior) and caloric test.

##### *Studies at completion of therapy (prior to discharge from hospital):*

Tuberculin test (first and second strength).

Roentgenogram of chest (posteroanterior; other views if indicated).

Smears and cultures from sputum or gastric washings. (When tubercle bacilli are recovered, streptomycin sensitivity is determined.)

(16) In order to obtain accurate records with a minimal variation due to meals, rest, et cetera, it is highly desirable that this procedure be accomplished at the same hour of the day each time it is performed.

TABLE 3. Dosage of old tuberculin given subcutaneously in initial course of treatment\*

Day of treatment	Old tuberculin	
	Bottle	cc.
1	-	-
2	6	0.2
3	8	0.4
4	8	0.6
5	5	0.8
6	7	0.2
7	7	0.4
8	7	0.6
9	7	0.8
10	6	0.2
11	6	0.4
12	6	0.6
13	6	0.8
14	5	0.2
15	5	0.4
16	5	0.6
17	3	0.8
18	4	0.2
19	4	0.4
20	4	0.6
21	4	0.8
22	3	0.2
23	3	0.4
24	3	0.6
25	3	0.8
26	2	0.2
27	2	0.4
28	2	0.6
29	2	0.8
30 to 42 (inclusive)	-	-

\*0.5 gram of streptomycin is given intramuscularly b. i. d. throughout the course. It is important that the nurse place her initials on the schedule after each injection given so that in the event of an error in dosage, it can be quickly discovered and remedied.

TABLE 4. Dosage of old tuberculin given subcutaneously  
in courses given after the first\*

Day of treatment	Old tuberculin	
	Bottle	cc.
1	8	0.5
2	8	1.0
3	7	0.5
4	7	1.0
5	6	0.3
6	6	0.6
7	6	0.9
8	5	0.2
9	5	0.4
10	5	0.6
11	5	0.8
12	4	0.2
13	4	0.4
14	4	0.6
15	4	0.8
16	3	0.2
17	3	0.4
18	3	0.6
19	3	0.7
20	3	0.8
21	3	0.9
22	2	0.1
23	2	0.2
24	2	0.3
25	2	0.4
26	2	0.5
27	2	0.6
28	2	0.7
29	2	0.8
30	2	0.9
31 to 50 (inclusive)	-	-

\*0.5 gram of streptomycin is given intramuscularly b. i. d. from the eighth through the fiftieth day.

### MODIFIED BED REST

During the combined therapy, patients having any complications of their pulmonary disease are kept at bed rest. Those without complications who remain in relatively good health, and those in whom complications are well controlled, are allowed to sit in a chair beside their bed early in treatment, and then gradually to be up and about their room as long as they feel no fatigue. At the first indication of mild fatigue they return to bed and rest until they are completely refreshed and again wish to be up. They are permitted to go to the bathroom and to engage in occupational therapy. If they have been at bed rest prior to admission, ambulation must be slow and graduated.

Mild exercise increases metabolism, and in turn respiration, pulse, and blood pressure. There is greater oxygen consumption. More oxygen is carried to the tissues. More blood passes through the infiltrated areas. The perifocal inflammatory reactions are increased. There may be greater absorption of toxin from foci and there may be metastasis of tubercle bacilli. In the presence of therapeutic levels of streptomycin, however, the escape of toxins and bacilli from foci is not undesirable as each reinoculation successfully combated helps the patient to build up his defense (17).

Controlled mild exercise in the phthisic, like that in the normal healthy person, increases the muscular tone, strengthens the heart action, increases the appetite, favors digestion, produces normal tiring, stabilizes the nervous system, and results in normal sleep. In short, it promotes normal physiology and biochemistry and helps a person to combat his disease by increasing his host resistance.

There is a critical period following the termination of the combined therapy when healing of tuberculous lesions by fibrosis is taking place. It is essential that patients be kept in bed during this period with the exception of necessary bathroom privileges. The period lasts from 3 to 6 months depending on the patient's progress and condition. Our patients have spent this period at their respective homes and, with one or two exceptions, have cooperated and responded excellently.

### OTHER METHODS OF USING STREPTOMYCIN-TUBERCULIN THERAPY

The methods described above are not the only means of combining tuberculin with streptomycin. Further observation and study may reveal more efficacious ways of combining the two agents, and when a better antibiotic is discovered, it is quite likely that tuberculin will enhance its action.

(17) Pottenger, F. M.: Tuberculosis. C. V. Mosby Co., St. Louis, Mo., 1948.

# Public Information in the Army Medical Service

Francis C. Nelson, Lieutenant Colonel, MSC, U. S. A. (1)

**A**SUBJECT of current interest in the Defense Department and other government agencies is management. Management, like perfection, is made of trifles, yet is no trifle. One of the "trifles" necessary to good management is information. Information, properly handled, is a basic management tool. Industrial or commercial management rests on production, finance, and sales. With slight changes in terminology, these same elements may be applied to management in government: (1) finance in the broad sense corresponds to fiscal planning, budgeting, and allied activities; (2) production to operations; and (3) sales to public acceptance. The success of a business operation depends on the acceptance of a product or service by the public in terms of sales, while the success of a government operation might logically be considered in terms of public acceptance of the agency itself and public satisfaction with the services it receives in return for the tax dollar invested in its activities. Public acceptance or dissatisfaction is measured in terms of increasing or decreasing appropriations.

This management concept is the framework on which an information program can be built. The Army lagged behind in the development of an information program and effective information policies between World War I and World War II. Reduced appropriations, failure of the Army to recover from the negative reaction to things military following World War I, general prosperity followed by a general depression, and mutual lack of understanding between military and civilian groups all contributed to the Army's failure to meet peacetime responsibilities other than those which were purely military. During and since World War II an effort has been made to establish a sound information program and policy.

The 2 basic types of information with which both business and government are concerned are internal and external. When properly coordinated they complement and support each other. One without the other is

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(1) Technical Information Office, Office of the Surgeon General, Department of the Army.

always in grave danger of losing its effectiveness. Unfortunately, the Army can gain the knowledge and experience which forms the basis of our military education and acquired skills only from war. A lesson learned, and poignantly demonstrated during World War II, was the fact that nothing was as harmful to the working efficiency and morale of men as speculation and rumor based on misinformation or lack of information concerning policies contemplated or about to be put into effect. Information programs designed to meet these situations can be classified as internal information.

Industry has long considered it good management policy to insure that all employees are aware of the latest developments in their field of interest. Employees who are well informed on current developments within the company are usually satisfied, enthusiastic, and willing to work as part of the team. Uninformed employees, left to guesswork and rumors, are generally dissatisfied, often disillusioned, and usually negative in their approach to their daily work. The purpose of an internal information program is to establish informal liaison between management and the individual employee with the general objective of letting every employee develop within himself a feeling of belonging. Once he feels he belongs, he begins to recognize his own importance as a member of the organization and assumes greater pride in the performance of his duties. He also takes more cognizance of the relation of his job to those of other workers near him.

An internal information program is like a subtle perfume; it pervades the atmosphere of an organization slowly and imperceptibly. The exact moment of awareness of its presence can seldom be measured, it seeps into consciousness gradually and there is a gradual realization on the part of all that there is something pleasant in the atmosphere. Thus, through information a favorable atmosphere of opinion is created within an organization. Under such conditions, work progresses smoothly and efficiently. The attainment of such working conditions is one of the primary objectives of management.

The Information and Education Program within the Army was designed to help commanders reach such objectives. Unfortunately, its success has varied in different areas to the extent to which commanders understood its objectives. There are some who believe the educational feature of this Program has been overemphasized to the detriment of the information program. Even with large areas of misunderstanding concerning the Program, it is generally understood better as an internal information program than public information is understood as an external information program. This is by no means a difficulty limited to those in government agencies. Business men have the same difficulties, but they are usually most willing, at least, to listen to the advice of those who do understand the problems of public relations and public information. Much of the difficulty that creates mis-understanding and distrust in public relations or public information can

be traced to semantics. Such terms as public information, public relations, publicity, propaganda, advertising, and so on have different meanings to different persons. Many of these terms have distasteful connotations to the average person because he has seen charlatans, masquerading as experts, exploiting the gullible and uninformed.

There have been many attempts to define public relations or public information. One of the shortest and simplest definitions describes public relations as "a way of life." Such a description fits because, in the final analysis, most problems in public relations can be reduced to the human relationship factor. As a way of life, public relations applies equally to the individual and to the corporate body. Individuals or corporations who conduct affairs with integrity, intelligence, and forthrightness have the first requisite of a good public relations program. In any task, program or project, public relations starts at the very core of the matter. It is not enough that a business or a government agency conducts its affairs in a straightforward and honest manner; it must also conduct its affairs with intelligence, and intelligence includes proper regard for public opinion. The "public be damned" attitude cannot survive the test of public opinion.

Unfortunately, most people think of public relations as some sort of magic formula by which the public or specialized segments of the public can be beguiled into accepting a given set of circumstances surrounding an action, either anticipated or consummated. Sugar coating the pill is not the job of a public relations officer, nor is it necessary if the action taken is intelligent and reasonable.

All too often the following train of events occurs. A staff officer has a general objective in mind. He discusses his basic plan with his staff and finally arrives at what he considers to be an acceptable plan. At that point coordination with one, two, or possibly more principal staff divisions is indicated. In accordance with sound procedures, the program is then discussed with other interested staff officers. The plan may be accepted as it is, or it may be revised to meet the objections or needs of other operating staff divisions. At that point the staff officer formulates the approved plan. His next step is to put it into operation. At this point someone may say, "We ought to get some publicity on this—better call the PIO." When the PIO (public information officer) arrives he is confronted with a plan which may contain some features that are objectionable from a public relations standpoint.

He then has only 2 alternatives. First, he can accept what is given him, wrap the package in pretty paper, tie it with fancy ribbons, and pray that nothing unexpected happens to tear the wrappings. He recognizes that from then on his job is going to be comparable to that of the volunteer fire department or rescue squad. When the wrappings get torn and the package is exposed, he will have to answer the distress signal with frantic patchwork. Second, he can voice his opposition to the objectionable portions of the plan. Although this would seem to be the

best solution, it is very difficult to change a program or plan once it has been approved and is ready to go into operation. Usually, about all the PIO can accomplish by this means is the acquisition of a reputation among the staff divisions concerned as being non-cooperative. Once he has gained such a reputation, he ceases to be of any value to his organization because the success of his mission depends on complete understanding and cooperation on the part of all executives.

To this day, public information officers in the Army are spending a great deal of time putting out fires caused by ill-conceived plans or operations which were launched 6 or 7 years ago. Chickens, as mother always said, come home to roost. As we are all aware, the Medical Service has its share of these problems. The best solution from the Army standpoint is the proper use of the PIO as a staff officer. As such he should be in at the start of the planning and as planning progresses he should be kept informed so that he may consider the possible public reaction to the program as conceived. If a program is logical, intelligent and necessary the PIO can do much to provide public acceptance of the plan with the proper use of information mediums, but even the most logical and well-thought-out program sometimes has "ticklish" aspects to it. These aspects require careful planning on the part of all staff members, including the PIO.

The Army's major problem, in the public relations field, is deciding the point at which public opinion may be disregarded because of the military necessity. Even in these instances proper public-relations planning can reduce public protest to a minimum. Although this is particularly true in wartime, it is also true that the Army must make its greatest effort to inform the public in peacetime. General patriotic fervor and support of the Armed Forces in times of national emergency usually create an atmosphere favorable to the Department of Defense. In wartime people want to be proud of their Armed Forces and tend to condone or accept actions of which they would be less tolerant in peacetime. When the shooting stops, however, bottled-up grievances are freely aired.

The Medical Service has a particularly complicated problem in the public information field in view of the fact that, as a technical service, the support and understanding of small but influential professional groups are required, and that the interests of special groups do not always coincide with those of the general public. Those activities that special groups would sometimes support most strenuously are often, in the public eye, not understood and not supported. Consequently, the welfare of the Army as a whole, for which the Medical Service exists, must be carefully considered in information planning.

In any public-information program the underlying consideration is purpose. A definite purpose should exist, and all elements of the program should be directed toward achieving that purpose. It may be to correct a misunderstanding on the part of the public, or a part of the

public, or it may be to prevent such a misunderstanding. Generally speaking, the information program of the Army Medical Service and of the Army as a whole should be directed toward obtaining positive results. Even though we are confident that we are fulfilling our medical mission with the Army, the support of public opinion cannot be expected unless the general public believes we are performing our job adequately.

The only means of demonstrating to the public that we are capable of accomplishing our mission is a sound information program directed toward enhancing the prestige of the Medical Service and attaining public recognition for our accomplishments, past and present. We must also do what we can to increase public understanding of our needs, our objectives, and the necessity for our actions. Once the Medical Service has won the support of the general public, and from those segments of the public on which we depend for our professional personnel and other needs, we will find an improved atmosphere in which we can go about our business. Basic to these objectives is the necessity of conducting our affairs in such a way that public confidence is maintained. That confidence, incidentally, can only be maintained by letting the public know what we are trying to do and what we are accomplishing.

To gain public support we must first take every step possible to remove that fear of the unknown which is normal to everyone. This can only be done by intelligent information planning at all echelons in the Medical Service. Our hospitals must have the community support because they are an integral part of the community in which they are located. Our station hospitals must have not only the support of the military community on the post on which they are located but also must do their share to help their post commanders achieve satisfactory community relations with the areas adjacent to the post. Although intelligent informational planning must be a staff function, all who serve in uniform should help the PIO develop a salable product.

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# Cyst of the Pancreas Associated With Diabetes Mellitus

Clyde W. Norman, *Commander, MC, U. S. N. (1)*

CYSTS of the pancreas are exceedingly rare and the association of a pancreatic cyst with diabetes mellitus is still more rarely found. The following case is considered worthy of reporting because of its rarity and because it serves to remind us that, although surgical conditions of the pancreas are not always implicated as etiologic factors in patients with diabetes mellitus, nevertheless, we should consider the surgical possibilities in diabetic patients whose symptoms and findings simulate those of the patient reported here.

## CASE REPORT

A 34-year-old man was admitted to this hospital for the repair of a recurrent ventral hernia which had followed an abdominal exploratory operation for acute pancreatitis. During the preceding 4 months the patient had complained of gaseous distention, belching, indigestion, and a feeling of fullness in the left upper abdominal quadrant when lying on his left side. He had lost 20 pounds. He had continued to imbibe excessive quantities of alcohol in spite of advice by many doctors to abstain totally. There had been increasing anorexia. His 66-year-old mother was a diabetic. At the time of the ventral hernioplasty the abdomen was not explored. One week following this operation a urinalysis showed the presence of a reducing substance. A blood sugar determination revealed 600 mg. of sugar per 100 cc. The diabetes was readily controlled by diet and insulin. The patient was maintained on 30 units of protamine zinc insulin administered daily before breakfast. In due time he was returned to a limited-duty status.

He was readmitted to the hospital for recurrence of the ventral hernia. Physical examination revealed a fairly large, hard, rounded mass in the left upper abdominal quadrant which was thought to be an enlarged

spleen or liver. Bone marrow, peripheral blood studies, and needle biopsy of the liver were within normal limits. Roentgenographic studies of the upper gastrointestinal tract with barium demonstrated an extrinsic upper abdominal mass displacing the stomach superiorly and medially (fig. 1).



Figure 1. Roentgenogram showing extrinsic compression of the greater curvature of the stomach and displacement of the stomach medially and superiorly.

An exploratory laparotomy was performed on 27 September 1950, at which time a large, thick-walled pancreatic cyst containing about 850 cc. of cloudy, amber fluid was found. The cyst was densely adherent to the posterior gastric wall, descending colon, transverse colon, mesocolon, and spleen. The body and tail of the pancreas were replaced by the cystic mass and only small scattered remnants of pancreatic tissue were noted on the posterior wall of the cyst. At this time macroscopic examination of the liver revealed no evidence of cirrhosis. A biopsy of the liver was contemplated but was deemed unnecessary after direct inspection and palpation of the liver. After much technical difficulty,

caused by the dense fibrous adhesions, the cyst was totally excised. The pancreas was resected to its neck. The duct of Wirsung was identified and the patent lumen was closed. The distal resected portion of Wirsung's duct was found to communicate with the cystic cavity. Because of the dense adhesions to the spleen, this organ was also extirpated. The blood supply to the transverse colon was questionable, and there was a possibility of damage to the middle colic artery, but, in spite of continuous whole blood transfusions throughout the operation, the patient's condition precluded any further operative procedures. A Chaffin-Pratt suction tube was placed down to the sutured end of the pancreas, and the abdomen was closed. Postoperatively, the patient responded satisfactorily with antibiotics and continued whole blood transfusions, having received a total of 5,200 cc. of blood during and immediately after operation.

The pathologist reported a large cystic mass which had been opened and which measured 12 cm. in diameter. The external surface was gray-pink and contained many fibrous tags. The wall was firm, rubbery, and averaged 5 mm. in thickness. The inner surface was flat, slightly roughened, and contained small amounts of adherent, green-brown, puttylike material. Microscopic examination of the wall of the cyst revealed it to consist of dense, hyalinized fibrous tissue containing islands of degenerated pancreatic tissue. There were foci of lymphocytic infiltration throughout the wall with areas of necrosis, recent and old hemorrhage, and calcification. There was no epithelial lining to the cyst and no evidence of malignancy. The pathologist's diagnosis was retention cyst of the pancreas. He stated that in consideration of the surgical findings, the patient's history, and the pathologic inspection of the cyst, it was possible that there had been an epithelial lining at one time which had degenerated and disappeared by long, continued pressure of the fluid within the cyst.

The postoperative course was stormy, but the patient's general condition was bolstered by intermittent whole blood transfusions. The diabetic status was but little influenced by the excision of the pancreatic cyst. Urinary sugar determinations revealed a trace to 3 plus sugar, and fasting blood sugars ranged from 69 to 350 mg. per 100 cc. The patient was maintained on from 10 to 15 units of protamine zinc insulin daily and regular insulin on a sliding scale. A fecal fistula from the transverse colon developed and was subsequently repaired by partial colectomy with an end-to-end anastomosis of the ascending and descending colon. Three weeks following this procedure, a hemorrhage from an eroded vessel of the mesocolon occurred, necessitating further colectomy. A subhepatic abscess eventually developed, resulting in a generalized peritonitis, and the patient died on 17 November.

#### DISCUSSION

The case records at this hospital were reviewed for the period from 1 January 1946 to 31 December 1950 and in a total of 127,018 admis-

sions for the 5-year period, only 3 cases of pancreatic cyst were uncovered, an incidence of 0.002 percent. Only 1 of these, the one reported here, had an associated diabetes mellitus. Davidson (2) related that only 3 pancreatic cysts were reported by Hale White in 6,708 autopsies. He further stated that in patients with pancreatic cyst the urine rarely shows glucose. Meyer et al. (3) reported that glycosuria was not detected in the routine urinalyses made in their 31 patients with pancreatic cyst. They quoted Warren as stating that, up to 1948, only 16 instances of pancreatic cyst had been encountered in the Lahey Clinic. The incidence of associated glycosuria or diabetes mellitus was not mentioned. Collins (4) found only 9 patients with pancreatic cyst in 209,813 consecutive admissions to the Hollywood Presbyterian Hospital, an incidence of 0.004 percent. He reported on a total excision of a pseudocyst of the pancreas, but diabetes was not found concomitantly nor was any mention made of that finding in the other cases he had reviewed in the literature. Christopher (5), in describing the symptoms of pancreatic cysts, stated that "the early symptoms are vague and may extend over many years, with chronic disease of the gallbladder as the lesion suspected. There may be a sense of fullness or discomfort in the abdomen or actual pain may be experienced. There may be flatulence, indigestion, or vomiting. Pressure may be exerted on the diaphragm, colon, and bile ducts. Jaundice is uncommon, loss of weight is rather frequent; glycosuria and diabetes are sometimes noted. The appearance of a tumor generally directs attention to the true nature of the trouble. It is usually a rounded or oval mass in the epigastrium, mostly in the midline, but sometimes to the left and only rarely moving with respiration. It may descend below the umbilicus, occasionally as far as the pelvis, and fill the abdominal cavity." Most writers agree that pain, usually in the midepigastrium or in the left upper abdominal quadrant, occurs in more than 85 percent of cases, irrespective of the presence or absence of associated disease of surrounding viscera.

Priestley (6) stated that in the laboratory studies of a suspected case, diabetes may be noted owing to the extensive destruction of the pancreatic parenchyma incident to an associated pancreatitis. He listed trauma and pancreatitis as the two most common etiologic factors in the development of pancreatic cysts, and a history of preceding pancreatitis is more frequently given than trauma. Cholelithic disease, gallstones in the ampulla of Vater, mechanical obstruction of the ducts by tumors, parasites, and cicatricial stricture following inflamma-

(2) Davidson, P. B., and Aaron, A. H.: Pancreas. In Piersol, G. M. (editor): Cyclopedias of Medicine, Surgery and Specialties. F. A. Davis Co., Philadelphia, Pa., vol. II, pp. 109-110.

(3) Meyer, K. A., Sheridan, A.; and Murphy, R. F.: Pseudocysts of pancreas. *Surg. Gynec. & Obst.* 88: 219-229, Feb. 1949.

(4) Collins, D. C.: Pseudocyst of pancreas, total excision, report of case. *Arch. Surg.* 61: 524-539, Sept. 1950.

(5) Christopher, F. (editor): Textbook of Surgery. 2d edition. W. B. Saunders Co., Philadelphia, Pa., 1939, p. 1283.

(6) Priestley, J. T.: Surgical lesions of pancreas. *Surg. Clin. N. America* 30: 971-986, Aug. 1950.

tory processes are other etiologic factors occasionally uncovered. Diabetes occasionally occurs as a result of acute hemorrhagic pancreatitis but, according to Walters and Clagett (7), there rarely is any evidence of deficiency of pancreatic secretion following pancreatitis. They state that von Schmieden reported 18 cases of diabetes subsequent to pancreatitis, the diabetes being caused by destruction of the islet cells. Small degrees of pancreatitis, together with island changes in the form of slight fibrosis, hyaline deposits, lymphocytic infiltrations, and reduced numbers and irregular forms of islands, may be found by careful search in most cases of diabetes mellitus at autopsy. On the other hand, competent pathologists have found the pancreas to be nearly or completely normal in large numbers of diabetic cases. Walters and Clagett further state that little is known of the cause of pancreatic cysts and experimental studies have added little knowledge. Acute pancreatitis, according to them, has been followed by the formation of cysts, and most of the patients operated on for cysts have shown manifestations of chronic pancreatitis. Most authorities conclude that a previous history of pancreatic or cholelithic disease is elicited by from 60 to 70 percent of the patients with pancreatic cyst.

The surgical management of cysts of the pancreas is still open to debate, but in general, the consensus is that total excision of the cyst, with or without partial pancreatectomy, is the procedure of choice when one encounters small cysts, particularly those which involve the tail of the pancreas. Large cysts usually are so densely adherent to surrounding tissues and organs that marsupialization and drainage are the most judicious methods of treatment employed in the majority of patients.

Brunschwig (8) stated that total pancreatectomy in the diabetic subject does not result in appreciable increase in the severity of the diabetes. In the case reported here, only partial pancreatectomy was performed and the diabetic status was altered very little. The daily maintenance dose of insulin postoperatively decreased to from 10 to 15 units, as compared to a daily preoperative requirement of from 30 to 45 units.

(7) Walters, W., and Clagett, O. T.: *Surgery of pancreas*. In Piersol, G. M. (editor): *Cyclopedia Medicine, Surgery and Specialties*. F. A. Davis Co., Philadelphia, Pa. vol. 11, pp. 126-128.

(8) Brunschwig, A.: *Pancreatic physiology in light of recent surgical experience*. (Editorial) *Surg., Gynec. & Obst.* 88: 266-267, Feb. 1949.

## BOOK REVIEW

The 1951 Year Book of General Surgery (July 1950-May 1951), edited by *Evarts A. Graham, A. B., M. D.*, Professor of Surgery, Washington University School of Medicine; Surgeon-in-Chief of the Barnes Hospital and of the Children's Hospital, St. Louis; with a Section on Anesthesia, edited by *Stuart C. Cullen, M. D.*, Professor of Surgery and Chairman of Division of Anesthesiology, State University of Iowa College of Medicine and Hospitals. 619 pages; illustrated. The Year Book Publishers, Inc., Chicago, Ill., 1951. Price \$5.

This book is composed of abstracts of articles selected by the editors from various journals received between July 1950 and May 1951. The opening remark reminds us that all surgeons are human beings, tend to be faddists, fear being thought of as "nonprogressive back numbers," and, as followers, may carry an idea far beyond the concept of its originator.

Part I presents the gist of 391 contemporary professional papers. These abstracts present many valuable advances of practical importance in the technic of various surgical procedures, exclusive of orthopedic and brain surgery; new concepts in establishing and maintaining normal physiologic status in surgical patients; re-evaluation of antibiotics, chemotherapy, and antiseptics in the field of surgery, and a comprehensive and timely coverage of surgery of the lung and thoracic cavity, mediastinum, bony thorax, heart, and major blood vessels. The book should be of value to general practitioners and to the surgeons by virtue of its having separated the wheat from the ever abundant chaff in the current surgical literature.

Part II is concerned with advancements in anesthesiology, subdivided into sections on agents and technics for special situations, various types of analgesia, analgesic drugs, muscle relaxants and the intra-venous use of barbiturates, inhalation therapy, and endotracheal technic. It contains much information of interest to the surgeon and to the anesthesiologist. Specially commended for the consideration of each member of a surgical team is the chapter entitled "Physiologic Changes During Anesthesia."

The book is well illustrated and comprehensively indexed.

—Col. H. Zelboefer, U. S. A. F. (MC)



patient are shown in table 1. The general symptomatology (table 2) observed agreed with that presented by other authors (4,5).

TABLE 1. *Initial symptoms in 25 patients with Q fever*

Symptom	Number of patients
Headache	12
Malaise	7
Head cold	4
Sore throat	1
Backache	1

TABLE 2. *Symptoms noted by 25 patients with Q fever*

Symptom	Percent of patients
Headache	80
Chills and fever	72
Malaise	60
Sore throat	48
Pain or tightness in chest	40
Cough	36
Neurologic	
Stiffness in neck	36
Photophobia	24
Stiffness in back	16
Vomiting	8

On admission these patients showed no physical signs except fever, the average temperature being 100.9° F. All were febrile during the course of the illness and their temperatures varied from 100° to 105° F. The average pulse rate on admission was 95. When the patients were febrile, a relative bradycardia was often observed. Frequently the patients did not appear as ill as the degree of fever would suggest. Inspection of the pharynx generally revealed only minimal injection. Two patients had definite pharyngitis. Transient pulmonary findings were noted in over one half of the patients. These included changes in breath sounds and fine rales. Decreased resonance on percussion was noted in 4 patients. Many of these chest findings were not discovered until inspection of the roentgenogram had shown discrete pulmonary lesions. One patient had a positive Kernig sign bilaterally, and a Babinski reaction of the left foot. Another patient (case 3) showed suggested evidence of meningism. As noted by previous investigators (2), splenomegaly and skin rashes are not consistently seen in patients with Q fever. In the present series, no patient had a rash. One patient had a barely palpable spleen, but there was no change in the size of the spleen during the period of observation. The duration of the illness varied from 2.5 to 16 days (average 8.5) in the untreated group of 11 patients. The remaining patients were given treatment which altered the expected course of the disease.

(4) Denlinger, R. H.: Clinical aspects of Q fever in southern California, study of 50 hospitalized cases. Ann. Int. Med. 30: 510-527, 1949.

(5) Oliphant, J. B., Gordon, D. A., Mess, A., and Parker, R. R.: Q fever in laundry workers. Am. J. Hyg. 49: 76-82, 1949.





Figure 3 (case 1). Rosetgramm of chest. Figure 4 (case 3) Rosetgramm of chest.

3

injected and a small cervical lymph node could be palpated on the left side. His leukocyte count was 9,000 with 66 percent polymorphonuclear cells. A roentgenogram of the chest was normal.

His temperature varied from 99° to 103° F. for 5 days, then returned to normal. He had several profuse sweats, but at no time did he feel very sick. He was discharged to duty on 10 March. A complement-fixation test for Q fever was negative 10 days after the onset and 50 days after the onset the titer was 1:320.

**Case 3.** A 19-year-old man, born in New York, was admitted to the hospital on 26 February 1951, the fifth day of his illness. At the onset he had a persistent headache and for 3 days prior to admission he had general body aching with chills and fever. Just prior to hospitalization he developed a nonproductive cough with some tightness in the chest. On admission he appeared ill, with a temperature of 99.2° F., a pulse of 88, a respiratory rate of 20 per minute, and a blood pressure of 140/70. His pharynx was slightly injected. His leukocyte count was 7,500 with 65 percent polymorphonuclear cells and 1 percent eosinophils. A roentgenogram of the chest taken on admission showed an area of increased density in the right axillary region and increased markings in the base of the right lung (fig. 4).

On the seventh day of his illness, the headache, which he described as throbbing and located over the forehead, became worse. His temperature had remained almost normal. On the following day, he complained of a severe persistent headache and photophobia. Examination revealed some stiffness in the nuchal region and a questionable tight Babinski reaction. The eye grounds were normal. During the next week, his neck stiffness and photophobia slowly decreased. His temperature rose to 99.9° F. on the thirteenth day, at which time his leukocyte count was 10,600 with 46 percent polymorphonuclear cells and a second roentgenogram of the chest was normal. The headache was difficult to control. Caffeine with sodium benzoate, calcium gluconate, and codeine were of little avail. Ergotamine tartrate gave temporary relief. By the eighteenth day after onset of his illness, he no longer complained of headache. He was discharged to duty on 13 March. A complement-fixation test for Q fever was negative 6, 10, and 49 days after the onset; and 93 days after the onset the titer was 1:20.

**Comment.** These patients were representative of the entire group. Case 1 presented the typical symptoms, physical findings, radiologic and laboratory results usually found in Q fever. Case 2 illustrated the course and findings in the 17 percent of the patients in this series who were febrile and had the laboratory findings of Q fever but no pulmonary or radiologic abnormalities. Case 3 showed the symptoms and pulmonary findings in a patient whose course was practically afebrile but who showed some neurologic findings. The diagnosis was confirmed in each

case by a late rise in the titer for Q fever complement-fixing antibodies. These patients show the variability of form and of the systems implicated in Q fever.

## DISCUSSION

An unusual chance to study Q fever was afforded by this outbreak. The incubation period for this disease is from 16 to 18 days, with range of from 13 to 32 days (2).

Denlinger (4) noted that several of the patients he reported on had been admitted to a communicable disease unit with a tentative diagnosis of meningitis. Two patients in the present series showed evidence of meningism, one of sufficient degree that a spinal puncture was performed. This patient had been admitted with dizziness, pain in the back and neck, chills and fever, and headache. Kernig and Babinski signs were present on the second day. The spinal fluid examination was completely normal. His symptoms and signs subsided in the subsequent 2 weeks. Case 3 in this series also had meningism, but no spinal tap was performed.

The usual routine serologic and agglutination studies have been reported as normal (2,4). The Weil-Felix agglutination studies were of special interest in this group. Because all of the patients had received routine typhus fever immunizations within the previous year, it was expected that elevated titers of the Proteus antibodies would be found. This was the case, but comparison of the serial determinations of the OX-19, OX-K, and OX-2 antibodies showed no significant titer changes during the periods of observation.

In this series, minor changes only were observed in the heterophile and cold agglutinin reactions during the course of the disease. A heterophile antibody titer of diagnostic significance was noted in one patient but it decreased as the disease progressed. Similarly, elevated cold agglutinin titers noted in two patients decreased to the normal range after the third week of illness. An early rise and later decrease in the non-diagnostic titer range of the heterophile antibodies and cold agglutinins is suggestive of an anamnestic reaction only.

The complement-fixation studies for Q fever were very significant. This group of patients came from 20 states; none were from California (9), 3 were from Pennsylvania (10). The initial serum specimen taken before the tenth day of the illness was negative in all patients except one whose serum was anticomplementary. By the third week of the disease, 5 showed low titers, and by the seventh week of observation, 16 presented elevated complement-fixation titers for Q fever. At the last

(9) Haebner, R. J., and Bell, J. A. Q fever studies in Southern California, summary of current results and discussion of possible control measures. *J. A. M. A.* 195: 145-303-305, Feb. 3, 1951.

(10) Jastrow, O. H., Bondi, A., Jr., and Siegel, M. M. Q fever, report of case in Pennsylvania. *Ann. Int. Med.* 30: 180-184, 1949.

observation, in the twelfth or thirteenth week after the onset of the disease, 4 more presented elevated titers. From this study, it is seen that late in convalescence some of the patients develop immune bodies against Q fever. Two patients with the typical clinical course did not show complement-fixing antibodies for Q fever even at the last observation period. The rather low titers of 1:20 and 1:40 found in some patients in the sixth and twelfth week suggest the possibility that the strain of *C. burnetii* in this area in North Africa is serologically slightly different from that of the antigen used.

#### SUMMARY

Twenty-five patients with Q fever were observed in Tripoli, North Africa. The clinical course was characterized by an abrupt onset with fever, headache, and an atypical pneumonitis. Four patients showed no abnormal radiologic findings. Two showed meningism. The roentgenograms showed a preponderance of the pulmonary lesions to be located in the lower two-thirds of the lungs and away from the hilar regions. Agglutination studies of routine types showed no diagnostic changes. The complement-fixation studies for Q fever showed a diagnostic rise in titer, usually by the sixth week after the onset. Several patients did not show an elevation in titer until the twelfth week. It is possible that this outbreak was caused by a strain of *C. burnetii* serologically slightly different from that of the antigen used.

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#### BOOK REVIEW

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The 1951 Year Book of Obstetrics and Gynecology (August 1950-June 1951), edited by J. P. Greenhill, B. S., M. D., F. A. C. S., Professor of Gynecology, Cook County Graduate School of Medicine; Attending Gynecologist, Cook County Hospital; Attending Obstetrician and Gynecologist, Michael Reese Hospital; Associate Staff, Chicago Lying-in Hospital; Author of *Office Gynecology*, *Obstetrics in General Practice*, and *Principles and Practice of Obstetrics*. 567 pages; illustrated. The Year Book Publishers, Inc., Chicago, Ill., 1951. Price \$5.

This volume maintains the high standard of excellence of previous editions. With the vast amount of literature pertaining to obstetrics and gynecology, and of endocrinology as related to these subjects, the selection of articles shows an erudite mind. Because much of modern gynecologic practice involves a knowledge of endocrinology, it is good to see this phase of the specialty given adequate space. This volume should be a part of the library of anyone who is practicing obstetrics or gynecology either as a general practitioner or a specialist.

—Commander R. E. Crowder, MC, U. S. N.

## BOOK REVIEWS

*Surgical Measures in Hypertension*, by Reginald H. Smithwick, M. D., Professor of Surgery and Chairman of the Department of Surgery, Boston University, School of Medicine, Surgeon-in-Chief, Massachusetts Memorial Hospital, Boston, Mass. Publication Number 61, American Lecture Series, a monograph in American Lectures in Surgery. 95 pages, illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1951.

This small monograph contains the essence of Dr. Smithwick's experience in the surgery of hypertension. It is compact, comprehensive and easily readable. To the medical profession as a whole, it is of value as a record of achievement and study; in particular it is an extremely helpful aid for students of surgery whose work will eventually lead them to the treatment of hypertension. The history of hypertension is briefly presented. The selection of patients for operation, the selection of an appropriate surgical procedure, the operative technic, and postoperative problems are discussed in detail.

—Maj. E. M. Aronstam, MC, U. S. A.

*Diseases of the Nervous System*, by W. Russell Brain, D. M. (Oxon.), F. R. C. P. (London), Physician to the London Hospital and to the Maida Vale Hospital for Nervous Diseases, Sometime Neurologist to the Infants' Hospital and Physician to the Royal London Ophthalmic Hospital. Theodore Williams Scholar in Physiology to the University of Oxford. Price Scholar in Anatomy and Physiology at the London Hospital. 4th edition. 1,002 pages; illustrated. Oxford University Press, New York, N. Y., publisher, 1951. Price \$8.50.

The first edition of this highly practical and valuable text on neurologic diseases appeared in 1933, it was thoroughly revised and rewritten in the third edition which appeared in 1947. The present volume follows an almost identical pattern to the previous edition, with the bibliography giving few references later than 1947. In many sections the text is almost identical. There are, however, new sections on leptospiral meningitis, temporal arteritis, infectious mononucleosis, sarcoidosis, and compression of the median nerve in the carpal tunnel. The sections on aphasia and arterial supply of the brain have been enlarged, and the recent work on the motor cortex, spasticity, sensation, and the frontal lobe receives passing mention. For the medical student and general practitioner this textbook continues to present a worthy, readable, and succinct volume, with a good index. It is not essential, however, to owner's of the third edition.

—Lt. Commander R. G. Berry, MC, U. S. N.

# Chemical and Biologic Studies on DDT Resistance of Lice<sup>(1)</sup>

Herbert C. Barnett, Captain, MSC, U. S. A.

Edward C. Knoblock, Major, MSC, U. S. A.

THE efficacy of DDT in controlling human body lice has been well established both by laboratory studies and by field tests. Bushland et al. (2, 3) found that in 24 hours 10 percent DDT killed 100 percent of the human body lice in beaker tests, in arm-and-leg tests, and in tests on grossly infested persons. They further found that the duration of effectiveness of a 10 percent DDT powder was between 30 and 40 days. Studies in the field (4-9) proved the success of DDT dusts in combating lice and epidemic typhus in many areas of the world. Early in 1951, reports were received from several Army organizations in the Far East Command that DDT dusts were not producing the expected degree of control on human body lice. Concurrently with these reports, numerous samples of 10 percent DDT dust were submitted to this laboratory for chemical assay. A visit by one of us (H. C. B.) to an area where large scale dusting was under way, indicated that the dust was being applied thoroughly and that the rate of application was equal to or in excess of the usually recommended dosage (1½ to 2 oz.

(1) From the 406th Medical General Laboratory.

(2) Bushland, R. C.; McAlister, L. C., Jr.; Eddy, G. W.; and Jones, H. A.: DDT for control of human lice. *J. Econ. Ent.* 37: 126-127, 1944.

(3) Bushland, R. C., McAlister, L. C., Jr.; Jones, H. A.; and Culpepper, G. H.: DDT powder for control of lice attacking man. *J. Econ. Ent.* 38: 210, 1945.

(4) Munro, J. W.: "DDT"; new insecticide. *Nature, London* 154: 352-353, Sept. 16, 1944.

(5) Soper, F. L.; Davis, T. A.; Markham, F. S.; Richl, L. A.; and Buck, P.: Louse powder studies in North Africa (1943). *Arch. Inst. Pasteur d'Algérie* 23: 183-223, Sept. 1943.

(6) Ortiz-Maniotte, C.; Malo-Jávera, F.; and Payne, G. C.: Control of typhus fever in Mexican villages and rural populations through use of DDT. *Am. J. Pub. Health* 35: 1191-1195, Nov. 1945.

(7) Wheeler, C. M.: Control of typhus in Italy 1943-1944 by use of DDT. *Am. J. Pub. Health* 36: 119-129, Feb. 1946.

(8) Stone, W. S.: Role of DDT in controlling insect-borne diseases of man. *J. A. M. A.* 132: 507-509, Nov. 2, 1946.

(9) Petrie, P. K. R.: Epidemic typhus in Southwestern Arabia. *Am. J. Trop. Med.* 29: 301-326, July 1949.

## DISCUSSION

The data presented herein establish that strains of human body lice, obtained from vagrants in Tokyo, are not completely controlled by DDT. Chemical analysis has indicated that several of the samples of DDT used in these tests were well within the specifications set for this insecticide. This study also establishes that these lice are highly susceptible to other insecticides. It must, therefore, be concluded that the strains of lice used in this work show a distinct resistance to DDT. Whether or not this resistance is natural or acquired cannot presently be demonstrated, but it is believed that the lice used have not been previously exposed to DDT, at least not for several months.

## SUMMARY

Evidence is presented to indicate that human body lice in Tokyo bear a distinct resistance to DDT. It is further indicated that this resistance manifests itself not only by limited mortality but also by the ability of surviving lice to feed readily. Tests with insecticides other than DDT gave much better kills.

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## BOOK REVIEW

*Human Biochemistry*, by Israel S. Klemer, Ph. D., Professor of Biochemistry and Director of the Department of Biochemistry, New York Medical College, Flower and Fifth Avenue Hospitals, Formerly Associate, The Rockefeller Institute for Medical Research, New York. 695 pages, 83 illustrations, 5 color plates. 3d edition. The C. V. Mosby Co., St. Louis, Mo., Publishers, 1951. Price \$7.

This new edition of a well-known textbook has incorporated within it all of the important advances in biochemical research made in the past 3 years. This book has become a standard reference work for students and clinicians. Its style is clear and concise. The new edition, like the earlier ones, stresses the clinical aspects of biochemistry without neglecting the fundamentals. The greatest revision is found in the chapters on mineral metabolism and water balance, respiration and acid base balance, blood coagulation, and vitamin A. The chapters on enzymes, vitamins, hormones and metabolism have been expanded. There is an excellent chart on the composition of foods and edible materials in the appendix. This book is recommended to all students and physicians who wish to understand the fundamental aspects of biochemistry as they are related to the clinical practice of medicine.—Lt. Col. T. A. Haedicke, MC, U. S. A.

# Neuropathy Caused by Intramuscular Injection

David J. LaFia, First Lieutenant, MC, U. S. A. (1)

**I**NTRAMUSCULAR injection of drugs is commonplace. Countless injections are given daily with little thought to potential untoward reactions. Considering this widespread practice the dearth of reported cases of neuropathy is surprising. Peripheral neuropathy following intramuscular injection results from: (1) direct injury to nerve fibers or nerve sheaths; or (2) a nonspecific, harmful reaction of nerves to such substances as lead, arsenicals, and antirabic or antidiphtheritic inoculations. The mechanism remains unknown, although Latimer (2) and others (3) attribute the neuropathy to an allergic reaction. Besides peripheral neuropathy radiculitis, meningoradiculitis, meningo-myelitis, or encephalitis may occur. In this article 2 cases illustrating the 2 types of nerve injury are reported.

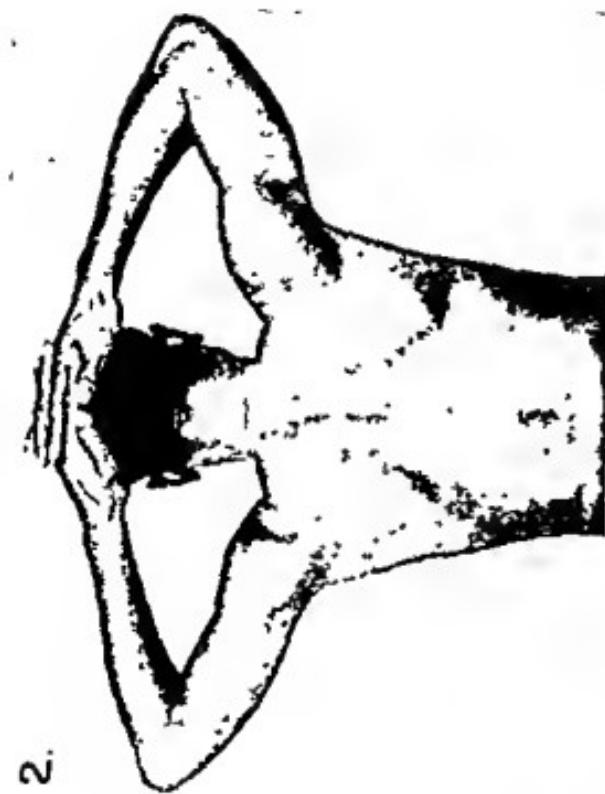
## CASE REPORTS

**Case 1.** A 27-year-old man entered this hospital on 19 January 1951 complaining of weakness in the left shoulder, limited extension of the left elbow, pain in the left cubital region, and wasting of the left biceps muscle. His disability began on 11 October 1950 several hours after inoculation in the left deltoid region with triple typhoid vaccine and tetanus toxoid. He said, "My left arm down to my fingers swelled and beat with pain." His entire left arm became edematous. The inner aspect of his left arm became acutely tender. Ten days later the arm had returned to normal size, but the patient was unable to raise it, or to extend the elbow. He complained of a persistent gnawing pain in the left cubital region. One week later he regained almost complete movement in the left elbow, although he still could not extend it completely. Because of continual pain and weakness in his left shoulder and elbow he was unable to perform full duty.

(1) At Madigan Army Hospital, Tacoma, Wash., at time of writing this article; now at U. S. Army Hospital, Camp Gordon, Ga.

(2) Latimer, F. R., et al.: Neurological complications of rabies vaccine; report of two cases. Arch. Neurol. & Psychiat. 65: 16-29, Jan. 1951.

(3) Grinker, R. R.: *Neurology*, 3d edition. Charles C Thomas, Publisher, Springfield, Ill., 1943. pp. 207-214 and pp. 788-792.



2.



Figure 1 (case 1). Note the atrophy of the left biceps and deltoid muscles. Figure 2 (case 2). Note the atrophy of the long head of the left triceps and the posterior fibers of the left deltoid.

Physical examination revealed: (1) moderate atrophy of the biceps, deltoid, and long head of the triceps on the left (figs. 1 and 2); (2) a slight weakness of left deltoid and triceps muscles; (3) extension of left elbow limited to 150°; (4) supination of left forearm limited to 50° from neutral position; (5) no sensory impairment; (6) tenderness over left cubital region; and (7) enlarged and tender lymph nodes in left axilla. A diagnosis of a nonspecific serum reaction causing neuropathy of the left axillary, radial, and musculocutaneous nerves was made. To rule out radiculitis and arachnoiditis of the cervical spinal cord, a lumbar puncture was performed. The spinal fluid findings were normal. The jugular compression test indicated absence of a subarachnoid block. Roentgenograms of the left shoulder, elbow, and cervical spine were normal.

Pain in the left cubital region was not completely alleviated by analgesics. Left stellate ganglion blocks were performed to give relief, but these were ineffective. Diathermy and massage were used several times weekly for 2 months. The pain gradually diminished and almost disappeared and movement in the left elbow improved. The atrophied muscles remained unchanged. The only significant residual was limitation of supination of the left forearm. This was apparently due to contracture of the left biceps tendon. The patient was returned to duty on 30 April 1951.

**Case 2.** A 24-year-old man entered this hospital on 4 January 1951 complaining of weakness of the left foot and leg, atrophy of the left leg, and occasional pain along the left sciatic nerve. His disability began in May 1950 after an injection of penicillin in the left buttock for gonorrhea. He said, "When they stuck the needle in my left hip I felt electricity run down the back of my left leg going to my toes. My toes then jumped." Following the injection his left leg had become weak and intermittently painful. He continued to perform full duty but by January 1951 his left leg had become noticeably smaller than the right and was so weak he could not walk.



Figure 3 (case 2). Note the atrophy of the left calf muscles.

Physical examination revealed: (1) atrophy of the left calf muscles (fig. 3). (2) 50 percent impairment of normal plantarflexion of the left foot; (3) barely perceptible dorsiflexion of the left foot; (4) impaired sensation over the lateral aspects of the left leg and foot; (5) hypoactive left ankle jerk; and (6) no fascicular twitchings of left leg.

From the clinical findings a diagnosis of direct injury to the left sciatic nerve was made. The patient was transferred to a peripheral nerve center.

#### COMMENT

Case 1 illustrates neuropathy occurring as a reaction following tetanus toxoid and typhoid vaccine and case 2 illustrates direct injury to a nerve. Because there is no known cure for neuropathy, emphasis must be placed on prevention. The following rules should be observed in giving intramuscular injections: (1) never use a needle longer than 3.5 cm.; (2) in injecting the gluteal region use only the upper outer quadrant and point the needle laterally; and (3) in injecting the deltoid region point the needle anteriorly and never inject lower than 5 cm. from the acromial process. In case 1, the patient was first seen for edema of the arm, and it is suggested that the use of an anti-histaminic drug might have lessened the intensity of the neuropathy.

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#### BOOK REVIEW

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*Cost of Medical Care, The Expenditures for Medical Care of 455 Families in the San Francisco Bay Area, 1947-1948*, by Emily H. Huntington. 146 pages. University of California Press, Berkeley and Los Angeles, Calif., publishers, 1951. Price \$2.50.

This interesting study of the cost of medical care in 455 families in the San Francisco Bay area in 1947-1948 provides a host of social, economic, and medical facts and figures. The comparison with previous studies well shows the sharp increase in medical costs. Only direct medical costs are included, the indirect expenses arising from a major illness may be equal or greater than direct, and data in this area is entirely lacking. The tabulations of disease by incidence and disease by cost are excellent and well indicate how the families' medical dollar is spent. The conclusions may be subject to argument, but the data is a valuable contribution to the problem, and the facts and figures presented give an excellent picture of the cost of medical care.

—Lt. Col. L. C. Kossutb, U. S. A. F. (MC)

# Persistent Trismus During Ether Anesthesia

William W. Montgomery, Lieutenant, junior grade, MC, U. S. N. R. (1)

**T**RISMUS may be defined as a tonic spasm of the muscles of mastication in the absence of temporomandibular joint pathology. I have found no report of persistent trismus during ether anesthesia in the literature. Clonic spasm of the masticatory muscles is frequently seen in ether anesthesia. Papper (2) mentions clonic and tonic phases of masticatory spasms occurring as a part of general muscular twitches during ether anesthesia. An unusually persistent case is reported.

## CASE REPORT

A 4-year-old boy was admitted to this hospital on 24 January 1951 for tonsillectomy and adenoidectomy. He had had repeated episodes of tonsillitis in the previous 2 years, acute catarrhal otitis media 3 months previously, and uncomplicated measles and mumps. He had been a mouth breather since infancy, had foul breath frequently, and had stertorous breathing while sleeping. On physical examination a wide nasal bridge, partial bilateral nasal obstruction, enlarged cryptic tonsils, excessive adenoid tissue and a few small, firm, nontender, lymph nodes in both cervical triangles were found.

On 25 January the child was taken to the operating room, 1 hour after receiving 25 mg. of demerol intramuscularly. Anesthesia was rapidly induced with fresh vinyl ether and he was carried to the first plane of the third stage of anesthesia. At this time, while the surgeon was attempting to insert a mouth gag, severe trismus was noted. The teeth were in tight opposition and the masticatory muscles were palpably boardlike. Attempts to insert the mouth gag and to proceed with the operation were abandoned after 45 minutes of deep ether anesthesia because of persisting spasm of the masticatory muscles. All other muscles of the child's body were entirely relaxed, trismus being the only abnormality to the deep ether anesthesia.

(1) U. S. Naval Hospital, Portsmouth, N. H.

(2) Papper, E. M.: Convulsions during inhalation anesthesia. Bull. U. S. Army M. Dept. (No. 84), pp. 81-85, Jan. 1945.

is involved. Cases have been reported involving even the ascending colon (6). Dalle Valle (9) was the first to describe absence of the myenteric plexus of Auerbach in the segments just distal to the dilated colon. The mechanism of production of the megacolon has been summarized by Swenson et al. (10) and Hiatt (7) who, by balloon kymographic studies, demonstrated normal peristaltic activity in the dilated colon down to the narrow sigmoid or rectum where absence of the myenteric plexus was demonstrated. It is believed that the peristaltic waves do not pass these areas because of the absence of nervous elements.

Modern treatment (7,8,10-13) resolves itself into resection of the denervated segment distally and a portion or all of the dilated colon above which the colon may be ulcerated as a result of stasis and infection. In infants, operation is usually postponed until 6 or 8 months after birth when the extent of the colonic dilatation is clearly delineated. Generally a primary anastomosis in one stage is performed. Swenson (11) recommended an operation in which the attachments of the dilated colon and all parts of the bowel distal to it are freed through an abdominal incision. The bowel is then artificially prolapsed and the dilated colon amputated just above the sphincter ani. The free end is anastomosed to the mucosal stump at the site of the amputation. He has reported 34 cases with one postoperative death. Hiatt (8) has described a similar procedure. The presacral space is drained regularly. These infants are maintained for a while on tidal drainage (11). Usually there is a mild diarrhea during the first few postoperative weeks but eventually the patient has 1 or 2 bowel movements a day. Resection of only the dilated segment of the colon has been practiced (14) but this method is little used in this country.

#### CASE REPORT

A 55-year-old man was admitted to this hospital on 16 July 1951 complaining of abdominal pain and distension of 2-day duration. He had had chronic constipation since birth. As long as he could remember, his bowels moved only once every 10 to 14 days. In October 1944, he had entered a hospital for an episode of "intestinal obstruction." A report

(9) Dalle Valle, A. Ricerche esotologiche su di un caso di megacolo congenito. *Bollettino 28*, 740-752, Aug. 15, 1920.

(10) Swenson, O., Rheinlander, H. F., and Diamond, L. Hirschsprung's disease: new concept of etiology, operative results in 34 patients. *New England J. Med.* 241: 551-556, Oct. 13, 1949.

(11) Swenson, O. New surgical treatment for Hirschsprung's disease. *Surgery* 28: 371-381, Aug. 1950.

(12) Lee, C. W., Jr., Bebb, K. C., and Brown, J. R. Selective management of megacolon in infants and children. *Surg., Gynec. & Obst.* 91: 281-293, July 1950.

(13) Dixon, C. F., and Judd, D. B. Symposium on surgical physiology, surgical treatment of congenital megacolon. *S. Clin. North America* 28: 897-901, Aug. 1948.

(14) Rivers, J. A., Hawthorne, H. R., and Metzger, H. W. Congenital megacolon, report of 3 cases of "obstructive" type treated by resection of dilated segment in contrast to resection of distal narrowed segment. *Pediatrics* 5: 791-795, May 1, 1950.

from that hospital revealed that this patient had been diagnosed as having a megacolon and an appendicostomy had been performed through the right rectus abdominis muscle. This procedure apparently relieved his distention in the following 2 years but no change in his bowel habits was noted and the appendicostomy had gradually closed. He stated that he had had no bowel movement for 22 days prior to admission. For the preceding 48 hours he had become greatly distended and had had low abdominal cramps which were associated with nausea, vomiting, fever, and malaise. Twenty-four hours prior to admission, he was taken to the hospital where he had been operated on and two enemas were given. This gave him some relief but because of recurrence of his distress, he was transferred to this hospital. There was no familial history of megacolon.

On admission the patient appeared to be acutely ill. His temperature was 101.8° F. His abdomen was greatly distended and slightly tender in all quadrants. No peristaltic sounds were heard. There was an incisional hernia through the lower portion of the right rectus abdominis muscle. A small fistulous tract discharged through this hernia. Rectal examination was negative.

On admission the patient's leukocyte count was 20,000. His serum protein level was 5.1 grams per 100 cc. A roentgenogram of the chest revealed a marked elevation of the diaphragm, particularly on the left side. Roentgenograms of the abdomen showed a large quantity of gas and feces in the intestines but no evidence of intestinal obstruction. An emergency barium enema (figs. 1 and 2) disclosed great dilatation of the descending colon which occupied almost the entire abdomen and displaced the ascending colon upward and to the left. There was an irregularity of the walls of the rectum with marked narrowing of the rectal ampulla. Sigmoidoscopy revealed moderate inflammation and edema of the sigmoid.

It was clear at this time that the patient's symptoms were due to a megacolon with secondary colitis and retention of fecal material. For the first several days, he was given nothing by mouth and fed intravenously. He received penicillin and streptomycin parenterally for his inflammatory lesion. A rectal tube was inserted and frequent rectal instillations of mineral oil were given which were later siphoned off. These measures were continued for several days and the leukocyte count dropped gradually to nearly normal. On the day following admission a large Foley catheter was inserted into the cecum through the appendicostomy opening and several irrigations with normal saline solution were given daily. Free drainage from the catheter was permitted between the instillations. On 21 July, small colonic irrigations with normal saline solution were started. Because the patient's afternoon temperatures reached 101° F. daily, treatment with aureomycin by mouth was started on 23 July. About this time he was placed on a soft diet with supplemental vitamin K and mineral oil by mouth. Siphonage from



FIGURES 1 AND 2. PREOPERATIVE HISTOLOGY OF MUSCLE.

the sigmoid shortly thereafter became easier and the fecal material thus obtained was liquid or mushy. The patient's temperature fell to normal on several days after treatment with aureomycin was started but occasionally reached 101° F. in the afternoon. An attempt was made to supplement the patient's oral intake of food by daily giving dextrose and amigen intravenously. On 31 July treatment with succinylsulfathiazole was started in a further attempt to sterilize the bowel postoperatively. The consensus was that we probably would be unable to eliminate this man's periodic elevations in temperature without removing the infected colon and its mesenteric attachments. On 3 August a laparotomy through the left rectus abdominis muscle was performed. The sigmoid and lower portion of the descending colon were greatly distended. Their mesenteric attachments were thickened and contained many swollen lymph nodes. The dilatation appeared to end at the ampulla of the rectum. The dilated colon was removed down to the peritoneal reflector about the rectum where a primary anterior anastomosis was performed, using intestinal chromic catgut for the inner layer suture and 000 silk for the seromuscular sutures. After covering the raw areas with peritoneum the abdomen was closed in layers. The appendicostomy catheter was permitted to remain in place during the operation and throughout the postoperative course.

The pathologist reported that the gross specimen consisted of a segment of large intestine measuring 32.5 cm. in length. Most of it was greatly dilated, the circumference being 16 cm. Toward one end it narrowed to 8 cm. The dilated portion showed hypertrophy of the muscular coat to a thickness of 0.6 cm. as compared with 0.2 cm. in the narrow segment. The mucosa presented unevenly distributed, superficial brown-colored ulcers. Microscopically, there was evidence of both acute and chronic ulcerative colitis. In the narrower segment, the myenteric plexus was so scanty that it could hardly be recognized. A diagnosis of congenital megacolon, with acute and chronic ulcerative colitis was made.

Postoperatively the patient was allowed up on the first day. Penicillin, streptomycin, and aureomycin were given parenterally. Intravenous feeding was employed until the seventh postoperative day. Normal peristaltic sounds were heard and the patient passed gas on the sixth postoperative day. Feeding by mouth was started on the seventh postoperative day. The patient had a normal bowel movement on the tenth postoperative day and from that time on had 1 or 2 normal, formed stools daily. No disturbance in electrolyte balance occurred postoperatively.

On the twelfth postoperative day, the patient gradually developed a pleuritic pain in the lower anterior portion of the chest on the right side. At that time, his temperature reached 101° F. and a roentgenogram of the chest revealed streaked densities in the base of both lungs suggestive of atelectasis. Bronchoscopy was negative and examination of

## BOOK REVIEW

*Tumors of the Skin, Benign and Malignant*, by Joseph Jordan Eller, B. S., M. D., Director of the Department of Dermatology, New York City Hospital, N. Y.; Consulting Dermatologist to French Hospital, New York; Morristown Memorial Hospital, Morristown, N. J.; Monmouth Memorial Hospital, Long Branch, N. J.; Fikitin Memorial Hospital, Asbury Park, N. J.; Norwalk General Hospital, Norwalk, Conn.; St. Clare Hospital, New York; Member American Dermatological Association, American Board of Dermatology and Syphilology; Academy of Dermatology and Syphilology, etc., and William Douglas Eller, M. D., Assistant in Dermatology and Syphilology, University Hospital, New York-Bellevue Medical Center; Associate Attending Dermatologist, New York City Hospital; Visiting Dermatologist, Municipal Sanitarium, Otisville, New York, etc. 2d edition, thoroughly revised and enlarged. 697 pages, 550 illustrations and 3 colored plates. Lea & Febiger, Philadelphia, Pa., publishers, 1951. Price \$15.

This book is a thorough revision of the first edition. The most recently described neoplasms of the skin and mucous membranes have been included. The number of illustrations has been generously increased. Each tumor is discussed from the standpoint of etiology, clinical appearance, course, histopathology, and treatment. The use of x-ray and radium in treating the various tumors of the skin is discussed in detail, including the recommended methods and dosages. Electrosurgical and surgical methods of treatment are also described. One chapter is devoted to the technic of cutaneous surgery and plastic repair of skin tumors. Another chapter is devoted to radiation physics and includes a number of useful tables and charts. The bibliography is comprehensive and up-to-date. Although this book will be of most value to the dermatologist, the surgeon, and the radiation therapist; the excellent descriptions and illustrations of such conditions as precancerous dermatoses, nevi, malignant melanomas, carcinomas, and lymphomas should render it useful to other specialists and to the general practitioner.

—Commander J. H. Albrittain, MC, U. S. N.

#### BOOKS RECEIVED

A Course in Practical Therapeutics, by Martin Emil Rebuffus, M. D., F. A. C. P., Professor of Clinical Medicine and Sutherland M. Prevost Lecturer in Therapeutics, Jefferson Medical College, Philadelphia; Attending Physician, Jefferson Medical College Hospital, Philadelphia, and Alison House Price, A. B., M. D., Associate Professor of Medicine, Jefferson Medical College, Philadelphia; Asst. Physician to Jefferson Medical College Hospital, Philadelphia; Chief of Diabetic Clinic, Curtis Clinic, Philadelphia. 2d edition. 938 pages; illustrated. The Williams & Wilkins Co., Baltimore, Md., publisher, 1951. Price \$15.

The 1951 Year Book of Radiology (June 1950-June 1951). Radiologic Diagnosis, edited by Fred Jenner Hedges, M. D., Professor and Chairman, Department of Roentgenology, University of Michigan, and John Floyd Holt, M. D., Associate Professor, Department of Roentgenology, University of Michigan. Radiation Therapy, edited by Harold W. Jacob, M. D., Professor of Radiology, College of Physicians and Surgeons, Columbia University; Chief, Radiation Therapy Division, Radiologic Service, Presbyterian Hospital, New York City, and Vincent P. Collins, M. D., Associate Professor of Radiology, College of Physicians and Surgeons, Columbia University, Director, Department of Radiation Therapy, Francis Delafield Hospital; Attending Radiologist, Presbyterian Hospital, New York City. The Year Book Publishers, Inc., Chicago, Ill., publisher, 1951. Price \$7.

*Your Diabetes, A Complete Manual for Patients*, by *Herbert Pollack, M. D.*, Associate Physician for Metabolic Diseases, Mount Sinai Hospital, New York. *Marie V. Krause, M. S.*, Consulting Dietician. Revised edition. 212 pages. Paul B. Hoeber, Inc., New York, N. Y., publisher, 1951. Price \$3.

*Surgical Practice of the Lahey Clinic, by Members of the Staff of the Lahey Clinic*, Boston. 1014 pages; 784 illustrations on 509 figures. W. B. Saunders Co., Philadelphia, Pa., publisher, 1951. Price \$15.

*Curare and Anti-Curare Agents*, by K. R. Unna (Conference Chairman), J. F. Artusio, A. L. Bennett, B. Berman, D. Bovet, J. C. Castillo, A. D. Console, M. A. Crews, E. J. De Beer, J. D. Dutcher, C. Eyzaguirre, R. V. Fanelli, F. F. Foldes, E. D. Goldsmith, H. R. Griffith, C. Hamilton, J. O. Hoppe, L. W. Jarcho, J. L. Lilenthal, Jr., A. R. McIntyre, B. E. Marbury, D. F. Marsh, S. Norton, W. D. M. Paton, E. W. Pelikan, A. P. Phillips, L. O. Randall, W. F. Riker, Jr., E. H. Sevinghaus, W. C. Wescoe, and A. L. Knuck. Editor: Roy Waldo Miner; Associate Editor: B. J. Henegan; Consulting Editor: J. A. Aeschlimann. *Annals of the New York Academy of Sciences*, Volume 54, Art. 3, pages 297-530.

*Antibiotic Therapy*, by Henry Welch, Ph. D., Director, Division of Antibiotics, Food and Drug Administration, Federal Security Agency of the United States Government, and Charles N. Lewis, M. D., Medical Officer, Division of Antibiotics, Food and Drug Administration, Federal Security Agency of the United States Government. Foreword by Chester F. Keefer, M. D., Wade Professor of Medicine, Boston University School of Medicine, Chairman, Committee on Chemotherapy of the National Research Council. 562 pages. The Arundel Press, Inc., Washington, D. C., publisher, 1951. Price \$10.

*Roentgen Examinations in Acute Abdominal Diseases*, by J. Friisvold-Dahl, M. D., Ph. D., Chief of Roentgen Department, Ullevaal Hospital, Oslo, Norway. 323 pages, illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1951. Price \$10.50.

*A Dictionary of Antibiosis*, Compiled by Leonard Karel, National Institutes of Health, United States Public Health Service, Federal Security Agency, and Elizabeth Spencer Roach. 373 pages. Columbia University Press, New York, N. Y., publisher, 1951. Price \$8.50.

*The United States Public Health Service, 1798-1950*, by Ralph Chester Williams, M. D., Assistant Surgeon General United States Public Health Service, Washington, D. C. 890 pages, illustrated. Commissioned Officers Association of the United States Public Health Service, Bethesda, Md., publisher, 1951. Price \$7.50.

*The Genetics of Micro-Organisms*, by D. G. Catcheside, Reader in Plant Cytogenetics, University of Cambridge; Fellow of Trinity College, Cambridge. 223 pages, illustrated. Pitman Publishing Corporation, New York, N. Y., 1951. Price \$4.50.

*A Study of Antimetabolites*, by D. E. Wooley, Member, The Rockefeller Institute for Medical Research. 269 pages, illustrated. John Wiley & Sons, Inc., New York, N. Y., publisher, 1951. Price \$5.

*The Battle for Mental Health*, by James Clark Moloney, M. D. 105 pages. Philosophical Library, New York, N. Y., publisher, 1951. Price \$3.50.

*The 1951 Year Book of Drug Therapy (September 1950-August 1951)*, Edited by Harry Beckman, M. D., Director, Departments of Pharmacology, Marquette University Schools of Medicine and Dentistry; Consulting Physician, Milwaukee County General and Columbia Hospitals, Milwaukee, Wis. 502 pages; illustrated. The Year Book Publishers, Inc., Chicago, Ill., 1951. Price \$5.

*Electrocardiographic Studies in Normal Infants and Children*, by Robert F. Ziegler, M. D., Associate in Cardiology, In Charge of Section of Pediatric Cardiology, Henry Ford Hospital, Detroit, Mich. 207 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1951. Price \$10.50.

*The Pathogenesis of Tuberculosis*, by Arnold R. Rich, M. D., Bayley Professor of Pathology, The Johns Hopkins University School of Medicine, Pathologist-in-Chief, The Johns Hopkins Hospital, Baltimore, Md. 2d edition. 1028 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1951. Price \$15.

*Physical Medicine and Rehabilitation for the Aged*, by Walter S. McClellan, M. D., Medical Director, The Saratoga Spa, Saratoga Springs, New York; Associate Professor of Medicine, Albany Medical College, Albany, N. Y. American Lecture Series Publication No. 105, A Monograph in American Lectures in Physical Medicine. 81 pages, illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1951. Price \$2.

The Temporomandibular Joint, Edited by *Bernard G. Sarnat*, M. S., M. D., D. D. S., F. A. C. S., Professor and Head of The Department of Oral and Maxillofacial Surgery, College of Dentistry; Clinical Assistant Professor Department of Surgery (Plastic Surgery), College of Medicine, University of Illinois, Chicago, Ill.; Diplomate of the American Board of Plastic Surgery. American Lecture Series Publication No. 134, A Monograph in American Lectures in Dentistry. 148 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1951. Price \$4.75.

Formulary and Therapeutic Guide, by *R. Gordon Douglas*, Chairman; *Donald A. Clarke*, Secretary; and *Norman Baker*, *Henry Barnett*, *McKeen Cattell*, *Herbert Conway*, *Cary Eggleston*, *August Groeschel*, *Vassar Johnson*, *Vernon Knight*, and *Ade Milhorat*. 355 pages. Appleton-Century-Crofts Co., Inc., New York, N. Y., publisher, 1951. Price \$3.

Measurement and Evaluation in Physical, Health, and Recreation Education, by *Leonard A. Larson*, B. A., B. P. E., M. Ed., Ph. D., Professor of Education, New York University, and *Rachael Dunaven Yocom*, B. A., M. A., Ph. D., Instructor in Education, New York University. 507 pages; illustrated. The C. V. Mosby Co., St. Louis, Mo., publisher, 1951. Price \$7.50.

Cardiac Pain, by *Seymour H. Rintler*, M. D., F. A. C. P., Adjunct in Medicine and Cardiovascular Research Unit, Beth Israel Hospital; Instructor in Rehabilitation, New York University College of Medicine; Associate Visiting Physician, Bellevue Hospital, New York City. American Lecture Series Publication No. 113, A Monograph in American Lectures in Circulation. 139 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1951. Price \$3.75.

Rehabilitation Nursing, by *Alice B. Morrissey*, B. S., R. N., Instructor in Rehabilitation Nursing, New York University-Bellevue Medical Center; Supervisor of Nursing Service, Department of Physical Medicine and Rehabilitation, Bellevue Hospital. Foreword by *Howard A. Rusk*, M. D., Professor and Chairman of the Department of Physical Medicine and Rehabilitation, New York University-Bellevue Medical Center; Associate Editor, *The New York Times*. 299 pages; illustrated. G. P. Putnam's Sons, New York, N. Y., publisher, 1951. Price \$5.

Penicillin Decade, 1941 - 1951, Sensitizations and Toxicities, by *Laurence Weld Smith*, M. D., Medical Director, Commercial Solvents Corporation, and *Ann Dolan Walker*, R. N., Former Editor, "Trained Nurse and Hospital Review." 122 pages. Arundel Press Inc., Washington, D. C., publisher, 1951. Price \$2.50.

Surgery of the Oblique Muscles of the Eye, by *Walter H. Fink*, M. D., Minneapolis, Minn. 350 pages; 93 illustrations, including 18 in color. The C. V. Mosby Co., St. Louis, Mo., publisher, 1951. Price \$8.75.

Observations on the General Effects of Injury in Man, With Special Reference to Wound Shock, by *R. T. Grant* and *E. B. Reeve*. Privy Council Medical Research Council Special Report Series No. 277. 313 pages. His Majesty's Stationery Office, London, publisher, 1951. Price about \$1.20.

Air War and Emotional Stress, Psychological Studies of Bombing and Civilian Defense, by *Irving L. Janis*, member The Rand Corporation. 280 pages. McGraw-Hill Book Company, Inc., New York, N. Y., publisher, 1951. Price \$5.00.

author proceeds with a discussion of dose-effect relationship, localization of site of action; absorption and distribution; fate of drugs; mechanism of action, chemical constitution and biologic action; and applied pharmacology. The material is carefully chosen and well presented. The bibliographies are comprehensive and valuable. For anyone entering the field of experimental pharmacology it will serve as a stimulating introduction to problems and procedures. To those working in allied sciences it should provide an understanding of the relationship of pharmacology to other branches of medical science, and even for the general reader it has a great deal to offer in interesting information.—Commander R. L. Taylor, MSC, U. S. N.

**Autopsy Diagnosis and Technic,** by Otto Sapir, M. D., Pathologist, Michael Reese Hospital; Clinical Professor of Pathology, University of Illinois Medical School, Chicago. Foreword by Ludvig Hektoen, M. D. 3d edition, revised and enlarged. 471 pages; illustrated. Paul B. Hoeber, Inc., New York, N. Y., publisher, 1951. Price \$6.

This book is well written and interestingly presented. It is well illustrated with black and white drawings which demonstrate techniques far better than printed words. I do not believe that this book would be of great value to a specialist in anatomic pathology, but its value should be tremendous to the beginner in pathology, and especially to the physician who only occasionally performs an autopsy. Many important details not ordinarily considered as a part of an autopsy are discussed. For example, the autopsy permit is described fully.

The autopsy procedure is discussed systematically from the external examination of the body to dissection of joints, peripheral nerves, et cetera. A special chapter is included on the autopsy of the stillborn. The various organ systems are taken up systematically, in each case describing normal appearance before the abnormal. The most common abnormalities are described succinctly along with the most common disease conditions which might produce such abnormalities. In nearly all chapters, tables giving the differential diagnostic features of lesions most commonly found in the organ system under discussion are included.—Col R. P. Mason, MC, U. S. A.

**The Normal Cerebral Angiogram,** by Arthur Ecker, M. D., Ph. D. (Neurology). Surgical Neurologist, Syracuse, N. Y. 190 pages, illustrated. Charles C Thomas, Publisher, Philadelphia, 1951. Price \$6.50.

This book is an inevitable and necessary evolution of the present day rapidly accumulating masses of arteriopolar studies. It contains the detailed anatomy of all the major vessels from their arterial entrance into the cranial vault to their venous exit from the skull. The first half of the book contains many practical points for locating and injecting carotid and vertebral arteries by the percutaneous method. The author offers the reader the technical tricks which he has developed as a result of experience. The cause, prevention, and treatment of 17 complications of arteriography (most are minor) are discussed.

The most welcome contribution is the anatomic detail which will help the clinician identify early peculiarities in distorted structure of the vascular tree. Embryologic background is suggested for certain abnormalities such as the carotid-basilar anastomosis. The discussion of the positions of the primitive olfactory artery is an example of the completeness and extent of the anatomic detail. The value of special roentgenographic views for enlarging the scope of the arteriographer's diagnosis is shown in several instances; for example, an optic foramen view was used to show arterial encroachment on the optic nerve in a patient with inferior altitudinal anopsia.

The author's system of numbering portions of the middle, anterior, and carotid arteries would seem to require learning certain bits of their anatomy by rote. It would have helped if they were given anatomic names rather than the oversimplified nomenclature of A2, C3, et cetera.

The venous anatomy is thoroughly discussed and well illustrated both by drawings and roentgenograms. Common artefacts and their identification and prevention are described. The last chapter is devoted to vascular relations to the tentorial notch and the foramen magnum with special emphasis on the knowledge of the normal anatomy of the posterior course of the anterior choroidal artery and the normal curvatures of the posterior inferior cerebellar artery.

This book will be welcomed by neurosurgeons, radiologists, and neurologists because of the ready availability of fine points in cerebral vascular anatomy in one well-indexed and well-illustrated volume.

—*Lt. Comdr. G. Clark, MC, U. S. N.*

**Epileptic Seizure Patterns, A Study of the Localizing Value of Initial Phenomena in Focal Cortical Seizures,** by Wilder Penfield, C. M. G., M.D., D. Sc., F. R. C. S., F. R. S., Professor of Neurology and Neurosurgery, McGill University; Director, Montreal Neurological Institute, Montreal, Canada, and Kristian Kristiansen, M. D., Assistant Surgeon, in charge Neurosurgery, Oslo City Hospital, Oslo, Norway, formerly, Research Fellow, Montreal Neurological Institute, Montreal, Canada. 104 pages, illustrated. Charles C Thomas Publisher, Springfield, Ill., 1951. Price \$3.

This monograph emphasizes the fact that analysis of the initial phenomenon or aura in an epileptic attack makes it possible to predict the localization of the focus in the cerebral cortex. The aura may be sensory, motor, psychical, autonomic motor and sensory, or a sudden loss of consciousness. Following the initial phenomenon there may be a grand mal seizure, but this latter has no localizing value. Only those patients with presumed focal cortical seizures are discussed; 259 patients were analyzed regarding the initial phenomenon of their attacks. Cortical exposure was performed on all patients. The majority had preoperative electroencephalograms and many had electrocorticography during operation. Thirty-seven patients were eliminated from the study because the localization of the origin of the initial discharge

was in doubt, 222 patients at operation showed evidence of localization, either by reproducing the aura or initial symptom by cortical stimulation, by gross pathologic evidence associated with electroencephalographic evidence of a spike focus, by gross pathologic changes alone, or by electroencephalographic evidence only. Of these, 122 had atrophic cortical lesions with meningeal adhesions, 37 had tumors, 18 had simple atrophic lesions of the cortex, and 17 had miscellaneous pathologic conditions. In 28 patients the nature of the pathologic lesion was not determined. The initial phenomenon of each patient was correlated with the findings on cortical exposure. A brief summarizing chart is presented, setting forth the correlation of different types of initial phenomenon with specific cortical areas.

This monograph throws further light on the functions of the various areas of the cerebral cortex. It points out that an aura, if analyzed accurately, has localizing value in most patients. It recommends in those patients with localizing aura followed by grand mal seizures that a diagnosis of focal cortical seizures be made, reserving the term epilepsy for those in whom no brain lesion or cortical focus can be demonstrated, the FFG showing bilateral 3-sec. synchronous waves of electrical potential. Neurosurgical procedures are not unduly emphasized nor are such studies as roentgenograms, pneumoencephalograms, and angiograms disparaged. This monograph is recommended to all who deal with epilepsy, including the general practitioner. Aura analysis may lead to a life-saving early removal of a cortical tumor. The physician will be reminded that a complaint of a feeling of unreality may be due to pathologic changes in a temporal lobe.

—Lt. Col. J. H. Sumner, Jr., MC, U. S. A.

The 1951 Year Book of Medicine (May 1950-May 1951), edited by Paul B. Beeson, M. D.; J. Burns Amberson, M. D.; William B. Castle, M. D.; S. M. (Hon.) Yale, M. D.; (Hon.) Utrecht, Tinsley R. Harrison, M. D.; and George B. Eusterman, M. D. 696 pages; illustrated. The Year Book Publishers, Chicago, Ill., 1951. Price \$5.

For a concise coverage of the significant literature relative to the field of internal medicine this Year Book is particularly recommended. The editors have done a good job in including abstracts of representative articles reflecting accurately recent advances and contributions. It is felt that if the contents of this book are digested the reader will have enhanced his knowledge and certainly made a sizeable effort at keeping abreast of the field. The index gives leads for more exhaustive reading in regard to the case at hand. A most practical method of using the Year Book is to read such abstracts as are pertinent to the patients currently being treated by the reader. The usual subspecialty division is made to include (1) infections, (2) the chest, (3) the blood and blood-forming organs, (4) the heart, blood vessels, and kidney, and (5) the digestive system.—Commander J. B. Mac Gregor, MC, U. S. N.

*Your Diabetes, A Complete Manual for Patients*, by *Herbert Pollack, M. D.*, Associate Physician for Metabolic Diseases, Mount Sinai Hospital, New York. *Marie V. Krause, M. S.*, Consulting Dietician. Revised edition. 212 pages. Paul B. Hoeber, Inc., New York, N. Y., publisher, 1951. Price \$3.

This book is a complete manual for diabetic patients and is designed to teach the patient what his disease is and what it means to him. The author emphasizes simplicity throughout the book, especially the manner in which a diabetic can maintain a normal way of life. The subject matter is presented in a very interesting way and the book makes delightful reading. The psychologic approach should aid in obtaining complete cooperation of the patient and relieves the doctor of explanations which are time-consuming. The various types of insulins and their actions are discussed as well as coma, insulin reactions, infections, care of the feet, and diet. The chapters on diet explain how the patient can cater to his racial dietary habits, and how to eat in a restaurant without being conspicuous. The method of calculation of diabetic diets and exchanges is simplified and explained thoroughly. This book is strongly recommended for all diabetic patients. All medical men who treat diabetics should be cognizant of the contents so that they can advise their patients of its availability.—Commander E. P. McLarney, MC, U. S. N.

*Clinical Laboratory Diagnosis*, by *Samuel A. Levinson, M. S., M. D., Ph. D.*, Director of Laboratories, University of Illinois Research and Educational Hospitals, Chicago, Ill.; Professor of Pathology, University of Illinois College of Medicine, and *Robert P. MacFate, Ch. E., M. S., Ph. D.*, Chief, Bureau of Laboratories, Department of Health, City of Chicago; Assistant Professor of Pathology, University of Illinois College of Medicine; Formerly Assistant Director of Laboratories, University of Illinois Research and Educational Hospitals, Chicago, Ill. 4th edition, thoroughly revised. 1146 pages; 221 illustrations, and 13 plates, 10 in color. Lea & Febiger, Philadelphia, Pa., publisher, 1951. Price \$12.

The fourth edition of this book on laboratory procedures brings to the technician, student and clinical pathologist the significant recent advances in the field of clinical pathology. Since its first publication in 1937, this book has enjoyed a deserved popularity among laboratory workers. It covers a wide field including chapters on skin tests, metabolism, blood chemistry, hematology, bacteriology, milk and water analysis, tropical diseases, histologic technic, and legal medicine and toxicology. In addition to detailing procedures, the authors include interpretation of results and general considerations of the diseases to which the tests apply. The usefulness of the chemistry section is enhanced by a statement on the principle of each test, a subject neglected by most laboratory manuals. The chemistry section also includes a concise description of visual and photoelectric colorimetry methods which will assist the student in understanding the operation of these instruments.

the chapter on preparations for delivery in the home listing articles to be included in the obstetrical bag, I should think that instead of pituitary extract, alphahypophamine should be listed; the size of the ampules of 50 percent magnesium sulfate should be stated; bichloride of mercury tablets are seldom, if ever, used; syrettes of morphine would be easier to use than the tablets; breast binders are seldom used and are unnatural (a good brassière is much better); and, finally, there is no mention of a bulb syringe, which is excellent for aspirating the baby's pharynx.—*Lt. Col. S. L. Avner, MC, U. S. A.*

**Essentials of Pharmacology,** by *Frances K. Oldham, Ph. D., M. D., Research Associate in Pharmacology, University of Chicago, F. E. Kelsey, Ph. D., Associate Professor of Pharmacology, University of Chicago, and E. M. K. Geiling, Ph. D., M. D., Frank P. Hixon Distinguished Service Professor, and Chairman of the Department of Pharmacology, University of Chicago.* 2d edition. 462 pages. *J. B. Lippincott Co., Philadelphia, Pa., publishers, 1951.*

This book, according to the preface to the first edition, is designed for use as an introductory text in pharmacology. It has been made as brief as possible, and it covers the field well for so short a presentation. The general classes of drugs are discussed adequately, but the value of the text might be increased by inclusion of a larger number of drugs. It has apparently been the aim of the authors and publishers to make this text inexpensive as well as brief. The printing is very flimsy for a book which is to be in constant use in study and the narrowness of the margins gives the pages a crowded appearance that distracts the eye and makes assimilation of the contents more difficult. Within its own set limitations, this book gives a satisfactory presentation of its subject.—*Commander R. L. Taylor, USC, U. S. N.*

**The Approach to Cardiology,** by *Crighton Bramwell, M. A., M. D., F. R. C. P., Professor of Cardiology in the University of Manchester, Physician to the Manchester Royal Infirmary, Formerly Professor of Systematic Medicine in the University of Manchester, Senior Censor of the Royal College of Physicians of London, Examiner in Medicine to the University of Cambridge, Edinburgh, Durham, Aberdeen, and Sheffield, with a foreword by A. V. Hill, C. H., O. B. E., Sc. D., F. R. S., Foulerton Research Professor of the Royal Society.* 122 pages, illustrated. *Oxford University Press, New York, N. Y., publisher, 1951. Price \$3.75.*

This short monograph consists essentially of a series of introductory lectures presented to students at the University of Manchester by the author. These lectures, a part of the series in medicine, are designed to illustrate the application of the preclinical sciences to cardiology. The contents reflect many of the personal contributions of this eminent cardiologist to the field of physiology and clinical medicine. This book is in no way a text in cardiology as the material presented scarcely covers the fundamental and general principles of cardiology. The author's manner of presentation and clarity of illustration are noteworthy, especially his explanations of the factors in the production of valvular murmurs and pulse formation. While much factual and prac-

tical clinical information is briefly presented, this is elementary in character and limited and superficial in scope. The material is excellent for the purpose for which it is intended. This monograph is only recommended, as the title implies, as an introduction to cardiology for the unexperienced student or clinician.—Col. T. W. Mattingly, MC, U. S. A.

*Visceral Innervation and Its Relation to Personality*, by Albert Kuntz, M. D., Ph. D., Professor of Anatomy, St. Louis University School of Medicine, St. Louis, Mo. American Lecture Series Publication No. 115, A Monograph in American Lectures in Anatomy. 152 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1951. Price \$4.50.

The author succeeds in presenting a detailed description of the anatomy and a brief summary of the physiology of the autonomic nervous system, including its central connections. The final chapter, entitled "Visceral Neural Factors in Personality," correlates the autonomic nervous system with the intellect, including their integration in such areas as the hypothalamus and thinencephalon which result in influences on personality, emotional behavior, and visceral regulation. Most of the emphasis in this chapter, and throughout the book, however, is placed on anatomic rather than physiologic data, and the last paragraphs give an Aristotelian attempt to use emotions, through a hierarchy of intellect over viscera, as a means to a greater appreciation of ethical values.

The book contains an up-to-date bibliography; one-quarter of its references are to literature of the past 3 years. Its format is excellent and special mention should be made of its many fine illustrations. The price is excessive considering its small size. The book is authoritative and useful but because most of its information is available in standard textbooks of physiology this monograph serves no useful purpose. The author's viewpoint is not that of the doctor at the bedside, but rather of the doctor in the laboratory.—Col. R. P. Johnson, MC, U. S. A.

*Cancer Cytology of the Uterus, Introducing a Concept of Cervical Cell Pathology*, by J. Ernest Ayre, M. D., Director, Dade County Cancer Institute, Cancer Cytology Center; and Chief, Cancer Research Department, Medical Research Foundation of Dade County, Miami, Florida; Formerly Director, Cytological Laboratories, Donner Building for Medical Research; and Lecturer in Gynecology and Obstetrics, McGill University; Associate Gynecologist and Obstetrician, Royal Victoria Hospital, Montreal. 407 pages; illustrated. Grune & Stratton, New York, N. Y. publisher, 1951. Price \$14.50.

This monograph describes and illustrates in a comprehensive manner the diverse cyrologic phenomena which the author has observed in his extensive studies of normal and abnormal conditions in gynecology. The format is excellent. There are numerous colored plates as well as black and white photomicrographs. The orderly arrangement and classification of lesions makes for clarity. The author enthusiastically advocates the cytologic method for both early diagnosis and investigation of pathologic processes but recognizes its limitations and the necessity for

properly correlating the clinical and histologic findings. Many of his patients have been followed for relatively long periods by both clinical and cytologic studies.

Attention is invited repeatedly to the important squamocolumnar junction of the cervix as the site of origin for both neoplastic and non-neoplastic disease. The author describes clearly and in detail his technique of obtaining specimens for cytologic study and presents convincing evidence of its superiority over other methods. His technic includes, in addition to the cervical secretions, a scraping of the entire circumference of the squamocolumnar junction. This is termed "surface cell biopsy." It is stated that better preserved and more representative, concentrated specimens are obtained without removal or destruction of tissue which would preclude further observation. In the absence of definite *in situ* carcinoma or invasive carcinoma of the cervix, which require definitive treatment, this comprehensive and atraumatic method is recommended for serial study to determine the fate of abnormal cells as a guide for both clinical treatment and research.

The description of normal cytologic findings in relation to the pregnant and the nonpregnant state, is followed by the abnormal changes which are classified as inflammatory, "neuro-carcinoma," noninvasive and invasive epidermoid carcinoma. On serial studies the inflammatory changes have been found to be reversible, but the cell changes in "neuro-carcinoma" and carcinoma *in situ* persist or progress to a more "anaplastic" state. "Neuro-carcinoma," employed as an alternative term for the precancerous stage, will probably remain a controversial subject. Some of the illustrations of cervical tissue sections presented as showing definite carcinoma are open to question. The author may not appreciate that rapidly proliferating or actively metabolic benign cells will simulate morphologically malignant cells.

In view of the increasing interest in exfoliative cytology in the past decade, this book is a timely and excellent presentation of the author's studies. The clinician should be stimulated to employ the cytologic method. This monograph should be a valuable text for the pathologist, cytologist, and laboratory technician.

—Commander E. B. Hopper, MC, U. S. N.

*Tonsil And Allied Problems*, by Roy H. Parkinson, M. D., F. A. C. S., Chief of Eye, Ear, Nose, and Throat Department, St. Joseph's Hospital, San Francisco, Calif. 432 pages; illustrated. The Macmillan Co., New York, N. Y., publisher, 1951. Price \$12.

Dr. Parkinson has done an excellent job in writing an entirely new book dealing with the tonsil and its related problems. Although the book is well written from the standpoint of the general practitioner, its greatest value will be to those practicing orolaryngology. The author gives a fine review of the anatomy of the tonsil and its adjoining structures. He discusses briefly the potential spaces around the tonsils, which are often omitted or inadequately described in similar texts. I was particu-

ly interested in the following statement on page 148: "Dingle and his co-workers stress the fact that all causes of exudative tonsillitis and pharyngitis are not due to streptococci. These observers have very frequently seen cases of acute follicular tonsils due to staphylococci. Dingle also points out that in their investigations at the Fort Bragg Hospital a large number of cases of acute follicular tonsillitis were seen in which the cause could not be found." I have had the same experience as Dr. Dingle in the last 3 years at the hospital mentioned.

Dr. Parkinson emphasizes the atraumatic technic in tonsillectomy, especially when dealing with chronic inflammatory diseases of the tonsils. He describes his method which should help many otolaryngologists in improving their own technic. The author does not advocate tonsillectomy as a cure-all, but places proper emphasis on the tonsils as a focus of infection and recommends a thorough and proper evaluation in the elimination of such foci. In chapter 16 the author covers the indications and contraindications for tonsillectomy. He advocates radiation of the spleen to increase the coagulability of the blood. He also describes the technic employed and gives sufficient reference should one desire to investigate this further.

I heartily agree with his statement that "the ideal result of tonsillectomy would be one in which a year after operation the pharynx appears to be as if the patient were born without tonsils."

—Col. S. L. Cooke, MC, U. S. A.

**A:** Cross Section Anatomy of the Brain, Guide to the Study of the Morphology and Fiber Tracts of the Human Brain. Fifth Section of Emil Villiger's Brain and Spinal Cord, 14th edition. Revised by Eugen Ludwig, Professor of Anatomy, University of Basel, Atlas further revised by A. T. Rasmussen, Professor of Anatomy, University of Minnesota. 63 plates. The Blakiston Co., Philadelphia, Pa., publishers, 1951. Price \$5.50.

This atlas supplies a long felt need for a series of brain sections arranged and compiled for quick reference. The full-page drawings are executed from exceptional preparations in the anatomic collections of the University of Basel and the University of Minnesota. Each sketch is complete as to major structures only, thus the reader is spared the many minute and irrelevant labels which might discourage and confuse him. Artistic license and a fine degree of tone and texture have been blended carefully in emphasizing the major tracts, which are often not clearly delineated in the original preparations. The book is divided into 3 parts. The first is a transverse series from the lower medulla to the upper midbrain; the second is a frontal series through the upper brain stem and cerebral hemispheres; and the third is a parasagittal series through the cerebral hemisphere. It is hoped that in future editions a small section of horizontal cuts at the level of the internal capsule and corpus striatum will be included in order to give a third dimensional aspect to the study. This book should be of particular value to those preparing for examinations in the structure of the central nervous system.—Lt. Col. Stephen Mourat, MC, U. S. A.

*Surgical Practice of the Lahey Clinic, by Members of the Staff of the Lahey Clinic, Boston. 1,014 pages; 784 illustrations on 509 figures. W. B. Saunders Co., Philadelphia, Pa., publisher, 1951. Price \$15.*

This volume, written in understandable English, brings the vast surgical experience of an outstanding clinic to the reader in usable form. Any surgeon, regardless of his experience, can profit by reading it. The preoperative technics employed, postoperative care, and the results obtained by the many contributors, all recognized authorities, enhance the value of this volume. The volume is divided into 11 sections and in these sections the major surgical problems commonly encountered are skillfully covered. The reader is guided systematically through the steps in the management of the patient which have served the author so well. Ample explanation is given as to why certain things are done, why certain procedures are avoided and how these procedures are carried out by acknowledged masters in their field. Many specialized fields in surgery with which I am relatively unfamiliar are presented in clear, easily readable sections.

—Col. J. E. Graham, MC, U. S. A.

*Physical Diagnosis, by Raymond W. Brust, A. B., M. D., F. A. C. P., Associate in Medicine, University of Pennsylvania Medical School. Introduction by Truman G. Schnabel, A. B., M. D., F. A. C. P. 294 pages; illustrated. Appleton-Century-Crofts, Inc., New York, N. Y., publisher, 1951. Price \$4.50.*

One may at first ask, "Why another book on physical diagnosis?" A perusal of this little book quickly answers the question. First, there's a wealth of material on physical diagnosis, presented systematically, beginning with the head and proceeding downward and inward. Second, it does not contain sections on roentgenology, electrocardiography, and other methods involving the use of precision instruments which unnecessarily clutter up other volumes on physical diagnosis. Such sections are inadequate and therefore of no practical help. Third, this book is pleasant to read. Throughout its pages the author presents relevant detail, stresses signs of practical importance, and distinguishes what is common from what is rare. As a result, this little book offers a thorough grounding in the art of physical diagnosis. The index is adequate. It is highly recommended.

—Commander M. T. Yates, MC, U. S. N.



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Subscriptions should be sent to the Superintendent of Documents, United States Government Printing Office, Washington 25, D. C.

Yearly subscription \$5.25; foreign subscription \$6.75

Single number, 45 cents

Exchange of publications may be extended to medical and scientific organizations, societies, and journals. Communications on this subject should be addressed to the Editor, U. S. Army Forces Medical Journal, Armed Forces Medical Publication Agency, 221 and F Streets NW, Washington 25, D. C.

VOL. III

MARCH 1952

NO. 3

# UNITED STATES ARMED FORCES MEDICAL JOURNAL

*Published Monthly by the Armed Forces Medical Publication  
Agency, Department of Defense*



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THE PRINTING OF THIS PUBLICATION HAS BEEN APPROVED BY  
THE DIRECTOR OF THE BUREAU OF THE BUDGET, OCT. 19, 1949

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UNITED STATES  
GOVERNMENT PRINTING OFFICE  
WASHINGTON : 1952

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The UNITED STATES ARMED FORCES MEDICAL JOURNAL represents the unification of the BULLETIN OF THE UNITED STATES ARMY MEDICAL DEPARTMENT and the UNITED STATES NAVAL MEDICAL BULLETIN. This joint periodical is the medium for disseminating information of administrative and professional interest to all medical personnel of the Department of Defense.

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OFFICE OF THE SECRETARY OF DEFENSE  
ARMED FORCES MEDICAL POLICY COUNCIL  
WASHINGTON, D. C.

MEMO: Personnel of the Medical Services of the United States  
Armed Forces

A basic responsibility of a medical officer is to make available to others any ideas he may have for improving the medical services. One medium through which this responsibility can be discharged so far as medical equipment is concerned exists at Fort Totten, New York. There is a tri-service laboratory which is equipped and staffed to translate these ideas into actual full-scale models for the purpose of developing equipment to be used by the medical services of the Army, Navy, and Air Force. Known as the Engineering Development Division, it operates under the administrative control of the Armed Services Medical Priorities Agency and the management control of the Armed Services Medical Material Charter Selection Committee.

Recently a tri-service team, comprised of medical supply personnel of the three military departments and representatives from the Engineering Development Division, visited medical installations in Korea and Japan to determine the adequacy of medical supplies and equipment in the Far East Commands and to obtain the ideas of those actually using medical facilities as to how it may be improved. Because of the findings of this engineering group and the many valuable recommendations made by medical personnel in the Far East in the most forward areas a number of projects will be undertaken by this laboratory either to develop new equipment or still further improve present equipment.

Every medical officer has the privilege and obligation of contributing to his medical service by suggesting improvements in the equipment which he is using. The suggestions should be submitted in writing with sketches or photographs if possible, turned directly to the Director General of the respective service. The Director General, after evaluating the suggestions, will recommend to the Engineering Development Division the projects to be undertaken.

*S. Randolph Lovelace Jr.*

A. Randolph Lovelace, Jr., M.D.  
Chairman

# Dextran Infusion in Normal Chinese Men<sup>(1)</sup>

H. L. Chang, M. D.

Joseph S. Chen, M. S.

C. H. Chiang, M. D.

M. L. Chen, B. S.

J. C. Yue, M. B.

**D**EXTRAN is a high-molecular-weight polysaccharide formed by the growth in culture of various micro-organisms, particularly that of the nonpathogenic *Leuconostoc mesenteroides*, in a substrate of sucrose and phosphate. The micro-organism produces an enzyme or enzymes which synthesize dextran from glucose molecules. It was first discovered by German workers who regarded it as a nuisance in sugar refining. Attempts to produce antibodies in rabbits revealed that dextran is nonantigenic. This led to extensive studies in Sweden as to the feasibility of its being used as a plasma substitute (2-6). It has certain theoretical advantages over other protein or nonprotein colloids in that it is nonantigenic, free from acid radicals, and can presumably be metabolized in the body (7). Reports from Sweden have shown promising results on its clinical use. Thorsen (6) observed 5 unfavorable reactions in 16,750 dextran-phosphate infusions. Tests in the United States, however, showed conflicting results. Turner et al. (8) reported that reactions were observed in 10 of 30 patients. On the

(1) From National Defense Medical Center, Taipei, Taiwan, China.

(2) Grönwall, A., and Ingelman, B.: Untersuchungen über Dextran und sein Verhalten bei parenteraler Zufuhr. Acta physiol. Scandinaav. 7: 97, 1944; 9: 1, 1945.

(3) Bohmansson, G.; Rosenqvist, H.; Thorsen, G.; and Wilander, O.: Clinical experiences with dextran as plasma substitute. Acta chir. Scandinaav. 94: 149-167, 1946.

(4) Ingelman, B.: Dextran and its use as plasma substitute. Acta Chem. Scandinaav. 1: 731, 1947.

(5) Grönwall, A., and Ingelman, B.: Dextran as substitute for plasma. Nature, London 155: 45, Jan. 13, 1945.

(6) Thorsen, G.: Recent investigations of properties of dextran. Nord. Med. 40: 2374, 1948. (Swedish text, summary in English.)

(7) Editorial: Dextran as plasma substitute. J. A. M. A. 139: 850-851, Mar. 26, 1949.

(8) Turner, F. P.; Butler, B. C.; Smith, M. E.; and Scudder, J.: Dextran: An experimental plasma substitute. Surg., Gynec. & Obst. 88: 661, 1949.

other hand Lundy et al. (9) administered dextran to 1,500 patients without untoward reactions. The reactions noted by various authors consisted of skin rash, urticaria, lumbar aching, asthmatic attacks, feeble pulse and fall of blood pressure, anxiety, and dyspnea, but it was generally agreed that the circulating volume in the cardiovascular system was well supported.

In most cases cited above, observations were made on surgical patients. It was thought that tests on normal persons might reveal more clearly the extent and nature of the reaction dextran could produce. This article deals with a study of dextran infusion in 90 normal men.

### EXPERIMENTAL

The dextran used was a 6 percent solution in saline in bottles of 500 ml. known as "clinical dextran." Two lots were used. Ninety normal Chinese men, most of whom were medical students, were used for the test. Table I shows their age, weight, and height.

TABLE I. Age, weight, and height of experimental subjects

Age (years)	Number	Weight (pounds)	Number	Height (inches)	Number
19	5	96-99	2	58-59	2
20-29	78	100-119	49	60-64	43
30-39	6	120-139	35	65-69	43
40-42	1	140-156	4	70-71.5	2

After the volunteers rested in bed for from 30 to 60 minutes in a special ward previously prepared for them, a brief physical examination was performed on each. Readings of temperature (rectal), pulse rate, respiration, and blood pressure were recorded. An erythrocyte count, hemoglobin determination, sedimentation rate, and plasma protein determination were made. A urine specimen was obtained from each for routine examinations. Then 500 ml. of dextran solution were given to each subject at a rate of from 4 to 13 ml. per minute. The shortest duration of infusion was 40 minutes, the longest 130 minutes (average 70). In no instance was the infusion interrupted because of untoward reaction. The temperature, pulse rate, respiration, and blood pressure were taken at 1, 3, 6, 12, and 24 hours after the completion of the infusion; the erythrocyte count was repeated at 1, 3, 6, and 24 hours; hemoglobin was determined at 3 and 6 hours; sedimentation rates and plasma protein determinations were made 6 hours after infusion; and urine was collected at 6 and 24 hours.

Sahli tubes were used for hemoglobin determination. For sedimentation rates, Westergren tubes were used and observations were made for

(9) Lundy, J. S., and others. Annual report for 1947 of Section on Anesthesiology, including data and remarks concerning blood transfusion and use of blood substitutes. Proc. Staff Meet., Mayo Clin. 23: 432-443, Sept. 13, 1948, 460-462, Sept. 29, 1948.

1 hour. Plasma proteins were determined photometrically according to Greenberg's method (10). The amount of dextran excreted in urine was determined by measuring reducing sugar after acid hydrolysis. The condition of full hydrolysis of dextran and least decomposition of glucose was previously worked out. To 0.25 ml. of urine, 1 ml. of twice normal HCl was added. The resulting mixture was then heated in a boiling water bath for 30 minutes to attain optimal hydrolysis. After cooling and neutralization the reducing sugar was estimated by the Folin-Wu method. All subjects were kept at bed rest and carefully watched for 24 hours. They were given full diet and fluids as desired. At the end of 24 hours they were discharged if no reaction occurred. Those with symptoms and elevation of temperature were kept under observation for another 24 hours until all symptoms subsided.

### RESULT AND DISCUSSION

**Reactions.** Untoward reactions in the form of urticaria, asthmatic attacks, etc., as reported by Swedish and American workers, were not observed in the present series. Pyrogenic reactions, however, were encountered. Eighteen of the 90 men showed some elevation of rectal temperature above 99.6° F. (table 2). The elevations were all found to occur from 3 to 6 hours after the infusion. Of the 18 cases, only 4 complained of discomfort, which consisted of feverishness, dizziness, headache, and anorexia; and 7 showed some increase in the pulse rate. Case 84 had the most marked reaction among the group. He had mild chilly sensation shortly after infusion, followed by feverishness, dizziness, and headache. His erythrocyte sedimentation rate was increased from 6 to 30 mm. per hr. There were no significant changes in blood pressure and urine output, however. The other 3 cases (8, 10, and 83) showed much milder reactions. All 4 recovered within 24 hours. All the 18 subjects, with the exception of the first, gave low initial values either in hemoglobin content or in plasma protein level, or showed marked drop in either value after infusion. Subject 83 gave a history of splenomegaly 1 year preceding this study. What bearing, if any, these facts may have had on the occurrence of thermal reaction is unknown.

**Temperature.** With the exception of subjects 8, 10, 83, and 84 it is difficult to say whether the slight rise in rectal temperature was entirely due to dextran. Seven subjects showed an initial rectal temperature of 99.6° to 100° F. before dextran was given. It is known that some variations in rectal temperature occurs in healthy persons (11). Therefore in the absence of subjective discomfort and an appreciable increase in the pulse rate, the reaction observed in the other 14 subjects was considered negligible. At the close of the experiment, 10 subjects (8, 10, 13, 51, 52, 55, 66, 70, 83, and 84) were selected from

(10) Peters, J. P., and Van Slyke, D. D.: Quantitative Clinical Chemistry, Vol. II: Methods. Williams & Wilkins Co., Baltimore, Md., 1932. p. 691.

(11) Best, C. H., and Taylor, N. B.: The Physiological Basis of Medical Practice. 4th edition. Williams & Wilkins Co., Baltimore, Md., 1945. p. 623.

TABLE 2. Rectal temperature, pulse rate, sedimentation rate, hemoglobin, and plasma protein in 18 subjects showing elevated temperature after dextrose infusion

Subject	Type of observation	Before infusion	Hours after infusion					Subjective discomfort
			1	3	6	12	24	
1	Temperature (°F.)	99.4	99.6	99.2	100.6	98.2	98.3	
	Pulse rate	76	84	82	76	68	72	
	Sedimentation rate	2			11			None
	Hemoglobin (percent)	60			72			
5	Plasma protein (gm. per 100 ml.)	7.4			6.66			
	Temperature (°F.)	99.4	99.2	99.4	99.6	101.0	99.0	
	Pulse rate	76	73	84	76	76	80	
	Sedimentation rate	4			9			None
8	Hemoglobin (percent)	7.0		70	64			
	Plasma protein (gm. per 100 ml.)	6.73			5.57			
	Temperature (°F.)	99.6	99.4	99.8	100.6	99.8	100.4	
	Pulse rate	78	79	61	92	83	92	
9	Sedimentation rate	3			6			
	Hemoglobin (percent)	84		80	62			
	Plasma protein (gm. per 100 ml.)	6.72			5.97			
								Feverishness, transient

TABLE 2. Rectal temperature, pulse rate, sedimentation rate, hemoglobin, and plasma protein in 18 subjects showing elevated temperature after dextran infusion—Continued

Subject	Type of observation	Before infusion	Hours after infusion				Subjective discomfort
			1	3	6	12	
10	Temperature (°F.)	99.0	98.7	98.9	100.0	101.0	99.6
	Pulse rate	64	60	72	80	96	90
	Sedimentation rate	3			7		
	Hemoglobin (percent)	82		80	80	5.44	
12	Plasma protein (gm. per 100 ml.)	5.43					
	Temperature (°F.)	99.4	99.2	99.2	100.0	99.8	99.8
	Pulse rate	68	64	65	66	64	70
	Sedimentation rate	2			4		
13	Hemoglobin (percent)	76		80	80		
	Plasma protein (gm. per 100 ml.)	5.37			4.93		
	Temperature (°F.)	100.0	99.8	99.8	100.4	99.4	99.6
	Pulse rate	76	74	78	80	70	88
	Sedimentation rate	3			12		
	Hemoglobin (percent)	86		75	76		
	Plasma protein (gm. per 100 ml.)	6.14			5.67		
							None

Feverishness and dizziness 6 hours after infusion



TABLE 2. Rectal temperature, pulse rate, sedimentation rate, hemoglobin, and plasma protein in 18 subjects showing elevated temperature after dextran infusion—Continued

Subject	Type of observation	Before infusion	Hours after infusion				Subjective discomfort
			1	3	6	12	
51	Temperature (°F.)	99.6	99.3	99.3	100.4	99.4	98.0 76
	Pulse rate	74	69	83	86	84	None
	Sedimentation rate	2			4		
	Hemoglobin (percent)	78		78	80		
	Plasma protein (gm. per 100 ml.)	7.11			4.90		
52	Temperature (°F.)	99.4	99.6	100.4	99.6	99.0	99.4 80
	Pulse rate	88	68	96	84	80	None
	Sedimentation rate	1			5		
	Hemoglobin (percent)	84		80	78		
	Plasma protein (gm. per 100 ml.)	7.60			5.60		
55	Temperature (°F.)	98.6	99.3	100.0	99.0	98.6	99.2 68
	Pulse rate	72	72	72	72	52	None
	Sedimentation rate	2			2		
	Hemoglobin (percent)	72		70	72		
	Plasma protein (gm. per 100 ml.)	7.56			5.98		

TABLE 2. Rectal temperature, pulse rate, sedimentation rate, hemoglobin, and plasma protein in 18 subjects showing elevated temperature after dextrose infusion—Continued

Subject	Type of observation	Before infusion	Hours after infusion				Subjective discomfort
			1	3	6	12	
66	Temperature (°F.)	99.8	99.1	99.9	100.6	99.6	99.4
	Pulse rate	63	64	64	63	80	86
	Sedimentation rate	3			8		
	Hemoglobin (percent)	72		70	64		
70	Plasma protein (gm. per 100 ml.)	6.02			5.70		
	Temperature (°F.)	100.0	100.1	99.8	100.6	99.6	100.2
	Pulse rate	72	62	80	65	60	68
	Sedimentation rate	3			3		
82	Hemoglobin (percent)	74		72	72		
	Plasma protein (gm. per 100 ml.)	6.52			5.92		
	Temperature (°F.)	98.6	99.0	98.6	99.8	100.0	99.6
	Pulse rate	84	82	88	102	90	74
	Sedimentation rate	8			26		
	Hemoglobin (percent)	70			64		
	Plasma protein (gm. per 100 ml.)	6.66			5.86		
							None

TABLE 2. Rectal temperature, pulse rate, sedimentation rate, hemoglobin, and plasma protein in 18 subjects showing elevated temperature after dextran infusion—Continued

Subject	Type of observation	Before infusion	Hours after Infusion				Subjective discomfort	
			1	3	6	12		
83	Temperature (°F.) Pulse rate Sedimentation rate Hemoglobin (percent) Plasma protein (gm. per 100 ml.)	97.0 76 3 82 6.21	97.4 72	98.6 84	100.0 92 18 66 5.79	100.8 88	98.7 72	Anorexia and dizziness for 48 hours
84	Temperature (°F.) Pulse rate Sedimentation rate Hemoglobin (percent) Plasma protein (gm. per 100 ml.)	97.8 78 6 72 6.40	99.6 86	99.3 96	102.0 88 30 62 6.34	99.0 84	98.0 84	Slight chilliness, followed by fever, headache, and dizziness for 12 hours
89	Temperature (°F.) Pulse rate Sedimentation rate Hemoglobin (percent) Plasma protein (gm. per 100 ml.)	99.6 88 6 76 7.40	100.3 84	100.9 84	98.9 78 13 64 5.80	98.2 62	98.8 64	None

the group of 18 with temperature elevation to have their 24-hour temperature checked under the same conditions but without dextran infusion. Two (52 and 55) were given 500-cc. normal saline infusion. In none was any elevation of temperature observed.

**Blood pressure.** In 60 percent of the subjects no change of blood pressure was observed incident to dextan infusion. An elevation of from 10 to 20 mm. Hg. was noted in the other 40 percent from 1 to 6 hours after the infusion. This elevation appeared to be within the range of normal fluctuation rather than the effect of dextran.

**Sedimentation rate.** The average rate in 89 subjects (1 undetermined) was 3.38 with a standard deviation of  $\pm 2.83$ . Except in 7 subjects whose rate 6 hours after infusion showed a decrease, the rest showed an average increase of 3.42 mm. per hr. with a standard deviation of  $\pm 4.94$ . The increases varied from none to as much as 24 mm. per hr. Most subjects had readings that were twice the original values. Bell et al. (12) stated that the sedimentation rate increases in proportion to the increase of the dextran level in the blood. Because readings were taken only once before and after infusion in the present study, we can only say that dextan did cause some increase of the sedimentation rate.

TABLE 3. Mean values (with standard deviation) of erythrocyte count, hemoglobin, and sedimentation rate in 90 men before and after dextran infusion

	Before infusion	Hours after infusion		
		3	6	24
Erythrocyte count (millions)	3.83 $\pm$ 0.33	3.45 $\pm$ 0.36	3.16 $\pm$ 0.33	3.80 $\pm$ 0.37
Hemoglobin (percent)	77.50 $\pm$ 4.64	74.50 $\pm$ 4.37	67.70 $\pm$ 4.30	
Sedimentation rate	3.38 $\pm$ 2.83		7.30 $\pm$ 5.34	

**Erythrocyte count and hemoglobin.** Studies by Thorsen (13) on 8 medical students showed a drop of about 10 percent in the hemoglobin, erythrocyte count, and the hematocrit readings. The drop was followed by restoration to or over the original level 1 hour later, and there was a second drop within the next 8 hours which lasted for more than 24 hours. In the present study erythrocyte counts were followed for only 24 hours and hemoglobin was determined at 3 and 6 hours. Our findings did not confirm the observations of Thorsen. The diluting effect disappeared at the end of 24 hours as shown in table 3. The erythrocyte count in the present series dropped an average of about 20 percent, the drop being most marked 6 hours after infusion in most subjects. The

(12) Bell, J. P., Fuckens, C., Square, J. R., Maycock, G. d'A., Spooner, S. J. L., Hollings, P. L., and Peterson, J. C. S. Dextran as plasma substitute. *Lancet* I: 134-143, Jan. 22, 1947.

(13) Thorsen, G. On dextran. Lecture given before the Swedish Medical Society, May 24, 1947.

drop in red blood cell counts was more marked in our series than in those of Thorsen, and is perhaps due to the slight degree of anemia commonly found among normal Chinese adults (14).

TABLE 4. Mean change (with standard deviation) of plasma protein level

Determination	Before infusion	6 hours after infusion
Plasma protein (gm. per 100 ml.)	6.45 ± 0.71	5.99 ± 0.61
Albumin (gm. per 100 ml.)	4.04 ± 0.38	3.72 ± 0.42
Globulin (gm. per 100 ml.)	2.32 ± 0.48	2.27 ± 0.16
A/G ratio	1.74 ± 0.53	1.63 ± 0.60

*Plasma protein and A/G ratio.* Thorsen (15) reported that the plasma protein level was reduced after dextran infusion. The reduction reached a maximum 6 hours after infusion and was followed by gradual recovery. A plasma protein value of as low as 2 gm. per 100 ml. was observed. A fall of plasma protein level was also observed in the present series. Except in 7 subjects whose plasma protein levels were not lowered by dextran infusion, the average values were 6.45 gm. per 100 ml. and 5.99 gm. per 100 ml. before and 6 hours after infusion respectively. The lowest value observed (subject 46) was 4.48 gm. per 100 ml. (7.4 gm. per 100 ml. before infusion) which agrees closely with the values reported by Bull et al. (12). The A/G ratio decreased from an average of 1.74 to 1.63. This slight change in A/G ratio confirms Thorsen's (15) finding that the reduction is greater in the albumin than the globulin fraction. It is our opinion that the fall of plasma protein level after dextran infusion was due more to the administration of fluid than to that of dextran. The change of A/G ratio, on the other hand, could be mainly effected by dextran. The results are shown in table 4.

*Renal excretion of dextran.* Twenty-four hour urine samples were collected from all 90 subjects at 6 and 24 hours after dextran infusion. The amount of dextran recovered in each period varied greatly. From table 5 it can be seen that the amount of dextran excreted in the first 6 hours after infusion varied in extreme cases from 2.5 times lower to 5.5 times higher than the amount excreted in the next 18 hours, the average being about 1.5 times higher. Bull et al. (12) reported that the amount of dextran excreted by 7 subjects in from 2 to 5 days varied from 9 to 26 percent. They reported on 1 patient with carcinoma who was infused with 30 gm. of dextran, and the amount excreted in 0 to 8, 9 to 16, and 17 to 24 hours was found to be 3.8, 1, and 1.2 gm., respectively. Bloom and Willcox (16) reported on 2 subjects

(14) Wan, S.: Health and nutrition in Chinese Army. Chinese J. Nutrition. 2: 45, 1947.

(15) Thorsen, G.: Dextran as a plasma substitute. Lancet. 1: 132-134, Jan. 22, 1949.

(16) Bloom, W. L., and Willcox, M. L.: Determination of dextran in blood and urine. Proc. Soc. Exptl. Biol. & Med. 76: 3-4, Jan. 1951.

into each of whom 30 gm. of dextran was infused, and the amount excreted in 24 hours was found to be 6.4 and 7.5 gm. Because individual variations are marked and the molecular size of the dextran used probably varies from batch to batch, data on renal excretion as obtained by various authors cannot be accurately compared.

TABLE 5. Renal excretion of dextran after infusion of 30 gm. of clinical dextran in 500 ml. of saline solution

	Dextran excreted					
	After 6 hours		Next 18 hours		Total in 24 hours	
	Grams	Percent	Grams	Percent	Grams	Percent
Lowest	0.50	1.66	0.11	0.38	0.61	2.04
Mean	1.05	3.49	0.71	2.37	1.76	5.87
Highest	2.90	9.67	1.17	3.29	4.07	13.56
Standard deviation of mean	0.45	1.46	0.43	1.40	0.64	2.08

### SUMMARY

Dextran infusions were given to 90 normal Chinese men. Each received 500 ml. of a 6 percent solution of clinical dextran intravenously. No skin reactions, asthmatic attacks or circulatory reactions were encountered. Mild pyrogenic reactions were observed in 4 subjects. Another 14 had a slight elevation of rectal temperature of no clinical significance. A drop in erythrocyte count and hemoglobin percentage and an increase in the sedimentation rate were observed after dextran infusion, the effect being most marked 6 hours after infusion. Erythrocyte counts returned to normal at the end of 24 hours. A fall of plasma protein level after dextran infusion was observed in most of the subjects. The fall was probably more related to fluid administration than to dextran. The decrease in A/G ratio after infusion was thought to be more directly related to dextran. Renal excretion of dextran was marked during the first 6 hours after infusion. Individual variations were marked in the amounts excreted.

NOTE: In the course of this study 2 emergency cases (multiple compound fracture and gastric hemorrhage) were given dextran infusion immediately on admission to the hospital. Both patients recovered. There was little doubt that the infusions helped to save these lives although no detailed studies were made.

ACKNOWLEDGMENT Grateful acknowledgment is made to the American Press for Medical Aid to China which obtained the dextran and transported it by air to Taiwan and made the grant under which the experimental work here reported was carried out.

# Delayed Primary Closures in War Wounds

Carl A. Broaddus, Jr., Lieutenant, MC, U. S. N.

WHILE medical officer in charge of the flesh wounds ward aboard the hospital ship U. S. S. *Haven* in Korea from 24 April to 7 October 1951, I had the opportunity to make the following observations relative to delayed primary wound closures. Two different technics of closure and postoperative management were used. In order to restrict coverage to these 2 technics, I shall discuss only patients that I operated on and, of these, only those who could be followed through to healing or failure. At times of mass embarkations, rapid evacuation of patients to Japan was necessary in order to keep beds available. This precluded postoperative evaluation of many patients.

During this time there were 56 patients (82 sutured wounds) who could be followed adequately. These patients came to us either directly from combat or via one or more field hospitals and on arrival their wounds were usually from 1 to 7 days old. Some had been adequately débrided, some only minimally (skin-edges trimmed but little more), and others had received only a battle dressing. They had almost invariably received daily injections of 300,000 units of procaine penicillin and a tetanus toxoid booster.

*Débridement and management prior to delayed closure.* In the treatment of these patients, many textbook precepts could not be followed, especially as regards débridement of all or nearly all war wounds. A man admitted with a fairly clean 4-day-old wound had nothing to gain from débridement. Instead, continuous daytime compresses of 0.5 percent acetic acid were applied to the wound (through a bulky dressing), and the dressing was changed every second day until the wound was ready for suturing, usually from 3 to 10 days later.

On the other hand, a badly contaminated wound, or a wound associated with swelling, discoloration, or gas in the tissues, would be débrided regardless of the age of the wound. Following débridement, unless the wound was over 13 cm. long, it was left open with Penrose

drains in any deep recesses and a bulky dressing was applied. Two days postoperatively the dressing was changed and the drains removed or shortened. Thereafter, acetic acid compresses were applied.

In patients in whom the débrided wound was fairly shallow as compared to the size of the skin defect, no drain was used and the wound was packed loosely with fluffed 4-by 4-inch dressings. A bulky dressing was then applied and treatment with acetic acid compresses was started on the same day. In general, therefore, if the acetic acid could be expected to reach the base of the wound, drains would be omitted because prompt institution of acetic acid compresses was found to shorten the latent period between débridement and closure. Patients experienced no pain on removal of these moist packs in which blood and serum were never given a chance to coagulate. This is in contrast to the wounds that we received which had been débrided elsewhere and in which there had been no chance to keep the dressings moist. The removal of these dressings was always painful even when preliminary moistening was carried out.

Ambulatory and semiambulatory patients were made responsible for keeping their own dressings wet at all times during the day. At night they were allowed to discontinue moistening the dressings. The 0.5 percent acetic acid was kept on the ward in a bottle with a rubber tube and stopcock for this purpose.

Wounds containing foreign bodies. The treatment of wounds containing radiopaque foreign bodies did not differ greatly from the treatment of other wounds similar in age and appearance, unless the foreign body was located in a joint or elsewhere so that incapacity might result from its presence. These foreign bodies were removed, preferably under spinal or general anesthesia, either through a surgical incision or, if practicable, through the wound of entry. All of these foreign bodies were located. In wounds requiring débridement any retained foreign body would be sought, though in the occasional patient in whom it could not be found, only surgical pride was believed to have suffered and the procedure was not protracted. Foreign bodies palpable beneath the skin were removed unless very small, either separately under local anesthesia or at the time of the débridement of the wound of entry.

General ward care of these patients consisted of: (1) giving 300,000 units of procaine penicillin daily until healing was complete, (2) giving 0.3 cc. of tetanus toxoid on admission, regardless of previous doses, (3) applying acetic acid compresses, (4) giving whole blood as indicated, and (5) giving 200 mg. of ascorbic acid daily from the day of wound closure until the sutures were removed.

#### DELAYED PRIMARY CLOSURE: TWO TECHNICS

All principles of treatment so far mentioned were standard throughout the period covered by this report. The delayed primary closures themselves, however, were performed in 2 different manners.

*Classical closure by layers, with drainage (group 1).* The first 32 wounds (in 22 patients) were closed employing the usually accepted technic for delayed closures. Each wound was excised in so far as practicable; bleeders were tied meticulously with No. 00 plain catgut; the wound was irrigated with saline solution (warm if available) and closed in layers using No. 0 chromic catgut for the deep fascia, No. 00 plain catgut elsewhere beneath the skin, and cotton or dermalon interrupted vertical mattress sutures for the skin. A small rubber dam (slip) drain was left protruding from the most dependent portion of the wound, except in face wounds, and was removed 2 days postoperatively. Cotton elastic bandages were used only occasionally, most dressings being held in place as snugly as possible with adhesive tape. Sutures were removed on the sixth, seventh, or eighth postoperative day, frequently half on one day and half on the next. Patients with leg and thigh wounds were allowed to be up and around minimally and were allowed bathroom privileges.

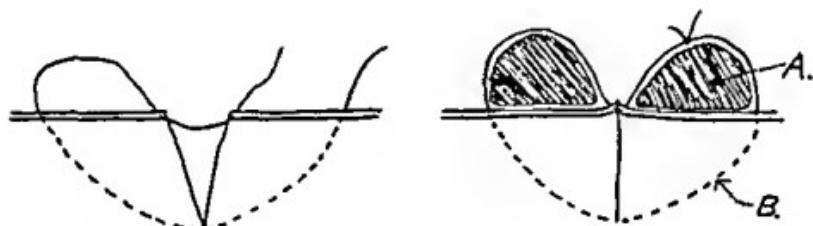


Figure 1. Technic of one-layer wire closure of war wounds. (A) 4- by 4-inch dressings rolled tightly longitudinally. (B) No. 009 steel wire suture extending to base of wound.

*Wire closure in one layer, without drainage (group 2).* Early in July I was introduced by Commandant S. H. Tolins, MC, U. S. N., to a new technic to which I have adhered with few changes. This technic was applied to 32 patients (50 wounds) who could be adequately followed. Following the usual excision of the wound, with clamping of bleeders, the wound was packed for a few minutes with warm ( $120^{\circ}$  F.) saline sponges. Clamps were then removed and no ties employed except on unusually large tissue bleeders which were tied with No. 0000 chromic catgut using about 2 such ligatures in every 3 wounds. Closure was effected with deeply biting vertical mattress sutures of No. 009 steel wire. The deep outside bite of each suture entered the skin from 2 to 2.5 cm. from the edge of the defect, traversed the base of the wound, and emerged similarly on the opposite side. The return throw of the suture caught only the skin edges. The sutures were all placed before tying and then tied over tightly rolled 4- by 4-inch dressings, one on each side of the wound (fig. 1). This prevented cutting the skin, provided a tamponading effect, and tended to evert the skin edges slightly. Although the wire sutures were tied only tightly enough for good skin approximation, no bleeding was noted after they were tied, and no hema-

omas were encountered. The skin edges were examined between the gauze rolls to see that no loose edges of the gauze were dipping into the wound and that the skin edges were accurately approximated. An occasional skin-edge suture of No. 000 dermalon was necessary midway between the wire sutures, which were placed about 2 cm. apart. A third rolled 4-by 4-inch dressing was tied into the free ends of the previously tied wire sutures and a dry sterile dressing applied. In addition a cotton elastic bandage was applied snugly to wounds of an extremity, shoulder, or buttocks from above the wound to the end of the involved part and left in place for 6 or 7 days (8 or 9 days for wounds below the knee or in wounds in which there was undue tension). In most thigh wounds and in all wounds of the elbow, wrist, knee, or ankle immobilization was insured by incorporating a molded plaster splint in the dressing. An airplane splint was used in wounds over the deltoid muscles or upper scapula. In trunk wounds, a cotton elastic bandage was left on for about 2 days before being removed for the sake of comfort. Strict immobilization of the part was demanded and patients with lower extremity wounds were kept in bed except for being allowed to go to the bathroom on crutches.

In an occasional wound, especially one about the forehead or smaller wounds elsewhere, No. 000 nylon or dermalon was substituted for the No. 009 wire (wounds 28, 42, 53a, 25b, 27a, and 49b). A No. 005 tantalum wire was used in 2 wounds (44b and 50a). Results were the same as for the No. 009 steel wire, and no further reference will be made to these variations.

## RESULTS

Tables 1 and 2 show the results in wounds sutured by the 2 major techniques discussed in this report. Wounds were not considered healed until 24 hours after removal of the sutures, at which time any separation of the wound edges or drainage was noted. Separations which healed spontaneously within 6 days, with or without acetic acid compresses, were classed as minor; those healing within 12 days, moderate; and those persisting beyond 12 days or requiring resuture, severe. Of the 32 wounds sutured in group 1, there were 8 separations, including 2 minor, 3 moderate, and 3 severe (one of which eventually required skin grafting and was healed 53 days after the initial sutures were removed). These 8 separations represented 25 percent of the wounds sutured by this technic.

Of the 50 wounds treated with the one-layer wire closure technic there were 4 separations (2 minor and 2 severe, one of which was not healed when the patient was transferred to another facility 9 days after the sutures were removed). It was estimated that healing would require 10 days more. The end of one of the gauze rolls had slipped between the edges of this wound and was not noticed at the time of operation. This was checked for in all subsequent operations. The other was resutured 3 days after removal of the sutures and was healed 12 days

after the original sutures were removed. A bullet was removed from this wound, the wound excised, and closure performed at the same operation. Results following this type of operation were poor with either of the technics described. The 4 separations in this group represented only 8 percent of the wounds thus treated.

A total of 107 days were lost because of wound separations in the 32 wounds of group 1, or 3.34 days per wound, although if the patient with a very ischemic lower leg wound above the medial malleolus of the tibia is omitted, this figure is reduced to 55 days lost or 1.77 days per wound.

In the 50 wounds of group 2, there was a total of 34 days, or 0.68 day per wound, lost beyond the expected day of healing. Here, too, if the patient in whom the gauze was allowed to remain between the edges of the wound is omitted, 16 days, or 0.33 day per wound, were lost. Using either the inclusive or the exclusive figures, this represents only one-fifth as great a loss of time beyond the expected day of healing as for the wounds of group 1 (table 3).

### DISCUSSION

This comparison assumes even greater significance in view of the fact that the patients of group 2 included the more severe wounds. Because of the rapid influx of patients before July, a more rapid turnover was mandatory. This necessitated evacuation of the more severely wounded patients who would otherwise have been kept after July and followed through to healing. Also, after the first few closures using wire, I found that large avulsions could be sutured by this technic and, even though under tension, all these wounds healed perfectly. I would previously have employed grafts on at least 4 of the patients with avulsion on whom I used wire and obtained excellent results despite tension.

*The possibility of postoperative herniations with the wire-closure technic.* I have been asked whether this one-layer type of closure might not predispose to herniations through fascial layers which are not individually sutured. I do not believe so. While placing sutures, it is wise to pull any major fascial layer, such as the fascia lata, toward the center of the wound, thus allowing a large fascial bite to be taken on each side of the wound. This should result in adequate approximation. If further experience proves this incorrect, I see no objection to suturing the fascia with a few wire sutures, *after* the placing of the deeply biting sutures but before they are tied. This would be similar to the treatment of wounds too deep for skin sutures to reach the bottom. I encountered 2 such wounds, both of the buttock, and closed them with buried wire sutures out to the point where deep vertical mattress sutures would reach. Healing was uneventful. Although no drains were employed after adoption of the wire technic, there were no infections and no retained blood or effusion.

TABLE I. Results of closure by layers with drainage

Type of management	Patient	Wound site	Time from débridement to closure (days)	Postoperative day sutures were removed	Postoperative day wound was healed	Time from admission to healing (days)	Time from wounding to healing (days)
Débridement with closure at same time	8a 8b 8c	Face Face Face	0 0 0	3 3 3	4 4 4	4 4 4	5 5 5
Débridement with or without removal of foreign body, closure later	1 2a(1) 2b 3 4a 4b 5 6 7 12a 12b 12c	Thigh Arm Arm Foot Thigh Thigh Forearm Leg Arm Arm Arm Deltoid	6 7 7 5 7 7 8 10 5 6 6 6	7 7 7 6 7 7 6 7 7 7 7 7	20(2) 8 8 7 8 8 7 21(2) 8 8 8 8	23 12 12 13 15 15 16 17 17 14 12 12	27 15 15 16 17 17 18 35 16 14 14 14
Acute acid compresses without débridement, delayed closure later	11a 11b 16a 16b 20	Burrock Burrock Thigh Thigh Thigh		5 5 7 7 7	6 6 8 8 9	16 16 11 11 13	17 17 14 14 20
Débridement with removal of foreign body and closure in same site	13 14 15a(3) 15b 16e	Neck Leg Leg Leg Arm	0 0 0 0 0	4 7 6 6 7	13(2) 11(2) 7 7 14(2)	14 14 8 8 15	17 16 12 12 18

TABLE I. Results of closure by layers with drainage—Continued

Type of management	Patient	Wound site	Time from debridement to closure (days)	Postoperative day sutures were removed	Postoperative day wound was healed	Time from admission to healing (days)	Time from wounding to healing (days)
Excision of foreign body, partial closure, final closure later	17	Leg	8	4	13(2)	23	28
	18	Leg	6	6	7	17	24
	19	Buttock	8	7	8	18	20
	22	Arm	8	9	10	20	26
	10	Leg	17	9	Needed reoperation (2) (4)		
Acetic acid compresses, later suture of previously debrided wound	9	Thigh	13(5)	7	12(2)	18	44
	10	Leg	29(5)	24	70	72	
	21	Thigh	15(5)	9	10	29	31
	Total Number		127	203	304	521	635
	wounds		17	32	32	32	32
	Average		7.47	6.34	9.50	16.3	19.8

(1) This patient needed physiotherapy to elbow for 11 days following wound healing. Function was but little improved so he was evacuated to Japan.

(2) These wounds were not satisfactorily healed 1 day after the removal of sutures.

(3) This patient needed physiotherapy for 5 days following wound healing to overcome slight foot drop.

(4) This man had a small arm wound 2 inches above the medial malleolus of the tibia. The wound was debrided and partially closed on day of admission. Seventeen days later, because the small defect had made no progress toward healing, delayed closure was attempted. This failed and subsequent grafting was necessary. The area of the wound was markedly ischemic, and closure should probably not have been attempted.

(5) These figures represent number of days from removal of suture or previous, unhealed, delayed closure to this resuturing, and are not included in the total or average of this column.

Fig. 2. Results of water storage in one layer without drainage.

Type of management	Patient	Wound site	Time from débridement to closure (days)	Postoperative day suture were removed	Postoperative day wound was healed	Time from admission to healing (days)	Time from wounding to healing (days)	Splint
26(1)	24	Chest	9	9	9	18	21	P
26(2)	26	Forearm	12	9	9	12	21	P
28(2)	28	Chest	11	7	8	13	19	P
30	30	Thigh	5	7	12(3)	15	18	P
31	31	Back	23	8	9	16	32	P
32a	32a	Leg	8	8	9	14	17	P
32b	32b	Leg	8	8	9	14	17	P
32c	32c	Foot	8	8	9	14	34(4)	P
33	33	Thigh	6	8	9	14	15	P
34(5)	34(5)	Arm	6	8	9	14	15	P
37	37	Back	8	7	7	8	22	P
39	39	flatocca	7	7	7	8	21	P
40a	40a	Arm	5	5	5	11	13	P
40b	42(2)	Arm	5	5	5	10	12	P
45	45	Knee	5	6	7	10	12	P
48	48	Leg	8	8	8	14	16	P
49a	49a	Thigh	8	8	9	15	17	P
50a(6)	50a(6)	Elbow	4	4	4	8	11	P
50b	50b	Leg	4	4	4	8	11	P
51	51	Thigh	5	5	5	8	14	P
52a	52a	Neck	9	9	9	8	14	P
52b	52b	Wrist	8	8	8	8	14	P
53a(2)	53a(2)	Arm	2	2	2	7	14	P
53a	53a	Chest	6	6	6	16	17	P
55	55	Thigh	5	5	5	7	15	P

TABLE 2. Results of *wire closure in one layer without drainage*—Continued

Type of management	Patient	Wound site	Time from débridement to closure (days)	Postoperative day sutures were removed	Postoperative day wound was healed	Time from admission to healing (days)	Time from wounding to healing (days)	Splint
	25a(2) (7) 25b(2) 27a(2) (8)	Arm Arm Forearm Thigh Thigh Thigh Knee Thigh Thigh Forearm Forearm Abdomen Abdomen Abdomen Neck Face Knee Knee Arm		8 8 7 7 7 7 7 7 7 7 7 6 6 6 7 3 7 7 7	9 9 8 8 8 8 8 8 8 8 7 7 7 7 8 8 8 8	12 12 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11	16 16 18 18 23 12 15 15 15 15 15 15 15 15 15 15 15 15 17	P P P
Acetic acid compresses without débridement, delayed closure later	41a 41b 41c 41d 41e 44a 44b(6) 46 49b(2) 53b(9) 53c 54h							
Débridement with removal of foreign body on closure in same stage	47 43	Thigh Thigh	0 0	7 7	7 8	Not healed (2)	11	
Excision of foreign body, partial closure, final closure later	23(10) 36	Thigh Buttock	15 11	7 7	9 8	24 20	26 21	

TABLE 2. Results of wire closure in one layer without drainage—Continued

Type of management	Patient	Wound site	Time from fieldment to closure (days)	Postoperative day sutures were removed	Postoperative day wound was healed	Time from admission to healing (days)	Time from wounding to healing (days)	Splint
Acetic acid compresses, later suture of previously debrided wound	38	Thigh	8(11) 3(11)	8 8	9 9	13 26	29 29	P
	47	Thigh						
		Total	213	355	420	689	868	
		Number wounds	30	50	47	49	49	
		Average	7.20	7.10	8.57	14.06	17.71	

P = Posterior plaster splint applied after suture.

A = Airplane splint applied after suture.

- (1) This patient needed physiotherapy to forearm for 3 days following wound healing.
- (2) 000 dermalon or oplos was used in place of steel wire.
- (3) These wounds were not satisfactorily healed 1 day after removal of sutures.
- (4) This patient had to be transferred to another facility 21 days after admission, 16 days after closure and figures are only approximate.
- (5) This patient needed physiotherapy to arm for 3 days following wound healing.
- (6) 005 teflonum wire was used in place of steel wire.
- (7) This patient needed physiotherapy to knee for 12 days following wound healing.
- (8) This patient needed physiotherapy to thigh for 6 days following wound healing.
- (9) This patient needed physiotherapy to knee for 6 days following wound healing.
- (10) This patient needed physiotherapy to thigh for 10 days following wound healing.
- (11) These figures represent number of days from removal of suture of previous unhealed delayed closure to this suture, and are not included in the total or average of this column.

TABLE 3. Comparison of the results of treatment in groups 1 and 2

Group	Number of wounds	Separations		Time lost because of separations (days)	Time lost (corrected figure) (days)	Time lost per wound (days)	Average time from expected healing to actual healing (days)	Average time from admission to healing (days)
		Number	Percent					
	32	8	25	107	55	1.77	2.16	16.30
	50	4	8	34	16	0.33	0.47	14.06

*Foreign body removal with delayed closure, one stage.* Uniformly poor results were obtained in wounds that were closed at the same operation in which a foreign body was removed. Of the 32 wounds in group 1, only 5 were treated in this manner. Yet of the 8 wound separations in this group, 3 came from those treated in this way. Similarly, of the 50 wounds in group 2, there were only 2 in which suture was performed at the time the foreign body was removed. One of these separated. This was the only separation encountered among the wounds of this group that required resuturing. Combining the 2 groups, it is seen that of 12 total wound dehiscences in 82 wounds, 4 came from a total of only 7 wounds sutured at the time the foreign body was removed despite what was considered adequate excision of selected wounds and irrigation.

*Return to duty.* All the patients included in these 2 groups were not necessarily returned to duty as soon as their wounds were completely healed. Eight patients (2 from group 1 and 6 from the more severe wounds included in group 2) were held over for physiotherapy; 5 of these were returned to duty within 6 days after healing and 2 more within 12 days. One had to be evacuated to Japan because the continued stiffness in his wounded arm was not improved after 11 days of physiotherapy. Six other patients were held over for eye refractions and completion of treatment of ruptured eardrums. All others were returned to duty with the next duty party after completion of healing.

*Cosmetic results* in wounds closed without tension were equal in the 2 groups of patients, depending not on the technic but on the accuracy of apposition. In wounds closed under tension the cosmetic results obtained by the wire technic were superior because of the absence of cross-hatching. In the one forehead wound sutured by the wire technic, a 4 by 3 cm. avulsion was closed and the sutures were removed 3 days later. The patient was followed for 9 days after removal of the suture while a thigh wound was undergoing débridement and subsequent closure. The resulting forehead scar was barely perceptible on discharge.

*Removal of sutures.* Sutures were left in place on an average of 6.34 days in group 1, as compared to 7.10 days in group 2. This difference was due in part to 3 face wounds (8a, b, and c) being included in group 1, from all of which the sutures were removed in 3 days, and to the removal of sutures from 2 other wounds at the end of 4 days because of the presence of infection, whereas in group 2 there was only one face (forehead) wound and no sutures were removed ahead of schedule. Omitting these wounds from both groups, the average was 6.89 days for group 1 and 7.18 days for group 2.

The average healing time after closure was 9.50 days in group 1 and 8.57 days in group 2, or 3.16 days after removal of the sutures in group 1 and 1.47 days in group 2. Since no wounds were considered healed until 1 day after the sutures were removed, this means a prolongation of healing of 2.16 and 0.47 days respectively for the two groups.

The time in the hospital until the wound was healed was 16.3 days for group 1 and 14.06 for group 2, or 19.8 and 17.7 days respectively from wounding to healing.

*Latent period between débridement and closure.* The average period between débridement and suture was 7.47 days in group 1 and 7.20 days in group 2.

### SUMMARY

The results obtained from delayed closures in group 2 were significantly better than those of group 1. The principal differences in treatment of the two groups therefore must be considered responsible. These differences were: (1) no buried sutures and an average of less than 1 buried ligature in the wounds of group 2; (2) smaller ligatures (No. 0000 chromic catgut rather than No. 00 plain catgut) were used in group 2; (3) one-layer rather than multilayer closures were used in group 2; (4) there was probably a reduced chance of tissue strangulation in group 2 because a through-and-through suture that merely approximates skin should also merely approximate deeper tissues, thus avoiding the common tendency to tie buried sutures too tightly; (5) after institution of the wire technic, warm saline solution was demanded for every wound whereas previously it had been used only when available (perhaps 30 percent of the time); (6) after adoption of the wire technic, complete immobilization of the sutured part was maintained whereas only decreased activity had been required of group 1 (11 plaster splints and 2 airplane splints were used in group 2 and none in group 1); (7) there may be less likelihood of fluids collecting in the one-layer closures (1); and (8) the possibility of improving surgical acuity having played an important part in the results is improbable because the improvement in results was not gradual but came about with the change of technic.

### CONCLUSION

The following factors appeared to play a major role in effecting an improvement in the results following delayed primary closures observed with the adoption of the one-layer wire technic.

1. Thorough irrigation of excised wounds with warm saline solution prior to closure.
2. Reduction of the amount and caliber of absorbable ligatures and of porous sutures such as cotton or silk, especially buried sutures. This reduction of ligature material and elimination of porous sutures is accomplished by the one-layer wire closure and is the principal goal of this technic.

(1) Despite the infrequent ligation of bleeders in these wounds, the combination of inward pressure from the gauze "rolls" tied beneath the free loops of the vertical mattress sutures and the outward pull of the deep limb of the same sutures (through the base of the wound) should, theoretically at least, provide an excellent tamponading effect. In practice this seemed to be the case.

3. Complete immobilization of sutured wounds until removal of the sutures, using splints if necessary.

Delayed primary closures of wounds should not be performed at the time of removal of foreign bodies because of the high incidence of wound separations in these patients.

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### BOOK REVIEW

*Measurement and Evaluation in Physical, Health, and Recreation Education*, by Leonard A. Larson, B. A., B. P. E., M. Ed., Ph. D., Professor of Education, New York University, and Rachael Dunaway Yocom, B. A., M. A., Ph. D., Instructor in Education, New York University. 507 pages; illustrated. The C. V. Mosby Co., St. Louis, Mo., publisher, 1951. Price \$7.50.

This is a comprehensive text dealing with the plan of measurement and evaluation in programs of physical education, health education, and recreation in relationship to the general field of education. Measurement is conceived as pertaining to those technics which furnish information about the product (the individual or group) of educational activity. Evaluation, on the other hand, is presented as concerning the process used in achieving results. According to the authors, a measurement and evaluation program should measure the product of the programs in physical, health, and recreational education and evaluate the process by which the results were attained.

This text comprises 5 sections, the first of which is devoted to a development of the basic philosophy. Section 2 covers the measurement of organic functions (nonlaboratory technics), motor skills, knowledge and attitudes, and individual adjustment. This latter factor includes the mental, emotional, and social aspects in addition to the physical. The third section presents the place of evaluation. Section 4 concerns analysis of program results, and the final section deals with administration.

Mention should be made of the use in this volume of "Photocode," a method for presenting pictorial illustrations in conjunction with step-by-step directions to simplify for the reader the various procedures in test administrations and statistical calculations. This text was written for use in both elementary and advanced courses in measurement and evaluation. Selected references supplement each chapter and permit further study on any particular problem.

—Lt. Col. J. B. Parsons, U. S. A. F. (MSC)

# Use of Plasma Expanders in Korea<sup>(1)</sup>

**I**N OCTOBER 1951, when Dr. W. Randolph Lovelace, II, Chairman of the Armed Forces Medical Policy Council, was in Korea on the first hop of his round-the-world trip to inspect U. S. military installations, it was pointed out to him that during winter operations in Korea, the medical aid men in forward combat areas had great difficulty in giving plasma because the diluent froze before it could be added to the dried plasma or, if the diluent had been kept from freezing, as soon as it was added to the plasma and exposed to the low temperature, the solution froze. This had been called to the Council's attention before Dr. Lovelace's departure from the United States and he was particularly interested in confirming the reports.

On his return Dr. Lovelace referred the problem to the National Research Council. He realized, however, that it probably would not be solved in time to be of any value to the winter just passed, because of the amount of research necessary, and that alternatives must be explored for a temporary solution. Discussions were held with representatives of the Defense Department's Committee on Whole Blood, Blood Derivatives and Plasma Expanders, which included not only military specialists but representatives of the National Research Council, the National Institutes of Health, and other interested agencies. It was determined that the amount of alcohol, salines, or carbohydrates which could be used safely in a diluent for the dried plasma would, at the most reduce the freezing point only 2° or 3° F. The use of concentrated human serum albumin (of which a large stock was also on hand) instead of plasma as an emergency measure presented the only rational solution for the immediate future, and one which may prove the most satisfactory even after extensive research. Instructions for its use were issued to the military departments.

Although concentrated serum albumin also has a freezing point within the 28° to 30° F. range, it is stored in small enough volume (25 grams in 100 cc. solution) that several ampules can be carried in the clothing of medical aid men operating in forward combat areas and in that way it can be protected from freezing. Furthermore, it does not have to be reconstituted prior to its use and can be injected rapidly before freezing.

<sup>(1)</sup> From the Armed Forces Medical Policy Council.

occurs. It combats shock most satisfactorily when there is little or no dehydration. Dehydration is recognized as an important, ever-present problem and instructions were issued requiring hydration either by mouth or parenterally at the earliest opportunity. Dehydration is not considered as great a danger, however, in winter as in summer. Some serum albumin was used successfully by the Marines during operations in the winter of 1950-1951.

Immediately following the Council's instructions in this matter, the Surgeon General of the Army directed that human serum albumin should be used by medical aid men in the field in subfreezing temperatures. In addition to pointing out the danger of dehydration, the directive made it clear that plasma would continue to be used in medical installations under cover where low temperatures posed no problem, and in both field and hospital facilities when temperatures were above freezing.

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# The Effect of Cortisone on Frostbite Injury<sup>(1)</sup>

Alton R. Higgins, *Captain, MC, U. S. N.*

H. A. Harper, *Pb, D.*

Bruce R. McCampbell, *Commander, MC, U. S. N.*

Joe R. Kimmel, *Lieutenant, MC, U. S. N. R.*

Thomas W. D. Smith, *Lieutenant, junior grade, MC, U. S. N.*

Richard E. Jones, Jr., *Lieutenant, junior grade, MC, U. S. N. R.*

Lueille R. Clark, *Lieutenant, MSC, U. S. N.*

Lila E. Suiter, *Lieutenant, MSC, U. S. N. R.*

M. E. Hutchin, *A. B.*

C. J. Rogers, *M. S.*

B. Edwards, *B. S.*

P. H. Distinct, *Pb, D.*

**F**ROSTBITE has assumed some prominence in recent phases of the Korean campaign as it has in other conflicts occurring in cold weather. The traumatic effect of cold is negligible under peacetime conditions when a person can take precautions or withdraw from the conditions causing injury. In that sense, frostbite is a preventable injury. Under conditions of war, however, several factors operate to increase the incidence of cold injury. Among these are inexperience of troops under cold weather conditions and failure to recognize the onset or implication of cold injury. Other factors adding to cold injury under war conditions are continued exposure with no opportunity to withdraw and the additional factor of dampness of clothing from perspiration or from contact with water.

Frostbite has come, through usage, to imply the cold injury which is incurred as the result of acute exposure of an extremity to temperatures below freezing. It is thus to be distinguished from general hypothermia (such as by immersion in cold sea water) and "immersion foot" (a term applied in World War II and implying the peripheral vascular neuropathy after chilling) which is due to prolonged exposure of the feet to moderate cold and wet conditions.

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(1) From the Metabolic Research Facility, U. S. Naval Hospital, Oakland, Calif.

Frostbite injury is described as:

*First degree* when there is injury of the skin only, without blisters. Healing takes place without residual scar.

*Second degree* when the injury is localized to the skin, with the formation of blisters. Residual local hyperesthesia, and sensitivity to cold may occur.

*Third degree* when there is more severe damage, involving subcutaneous tissue, muscle, or bone. Total freezing of an extremity is rare. Sequelae depend on the extent of necrosis. Following the demarcation of viable tissue in 3 or 4 weeks, it is common to find more living tissue than was expected.

TABLE I. Comparison of cortisone-treated and control groups

Patient	Age (years)	Duration of disease (days)	Extent of frostbite
<b>Group 1 (control)</b>			
1	22	24	Distal one-third of both feet; heels of both feet
2	21	18	All toes.
3	20	22-25	All toes.
4	48	14	All toes of right foot.
5	20	25	All toes of left foot.
6	28	23	Distal segments of all toes.
7	23	20	All toes.
8	21	18	Great toes of both feet.
<b>Group 2 (treated)</b>			
9	19	22	All toes; sole of right foot.
10	20	22	All toes; soles and heels of both feet. All fingers.
11	20	26	Great toes of both feet; second toe of right foot.
12	20	22	All toes of right foot.
13	20	28	Tips of first 3 toes of both feet.
14	20	25	Fingers of right hand.
15	21	25	All toes of right foot; first and second toes of left foot.
16	19	19	All toes of both feet.

Much has been written concerning the pathogenesis of frostbite. Essentially, it is necrosis of more or less tissue following the anoxia induced by freezing. The extremities are involved most often because of their relative lack of insulation by fat tissue, their exposure, and, in the case of the feet, by the effect of water content in the foot covering because water conducts heat over 20 times more rapidly than air.

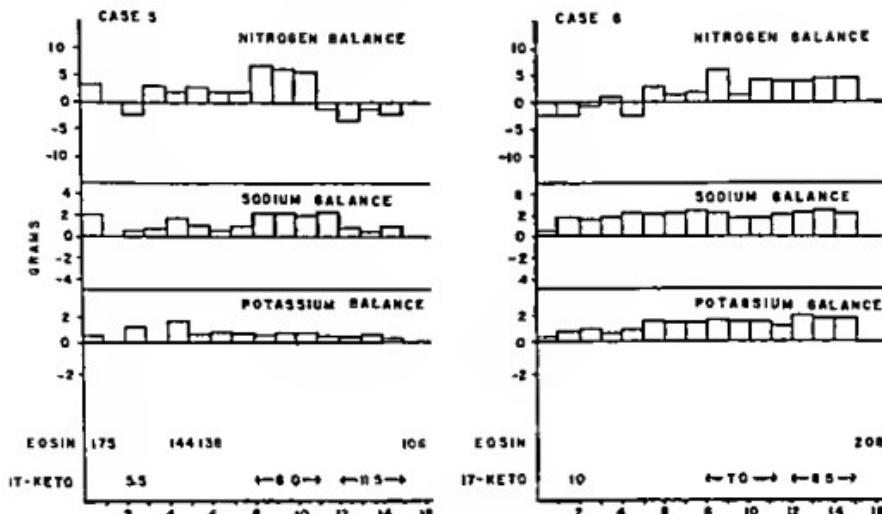


Figure 1. Studies of two control patients.

In the early stages of cold injury, when prevention of frostbite might be possible, there is little pain and sensations of cold and numbness are the only warning that freezing is occurring. These sensations are adequate warning to persons who are familiar with frostbite, but may be ignored by the inexperienced. The progress of the injury, if unchecked, is through the stage of vasoconstriction and anoxia, with blue-white or red skin. The part is stiff to the touch. As thawing takes place, a painful period of hyperemia is observed. The skin becomes intensely pink. Hyperemia continues with blister formation

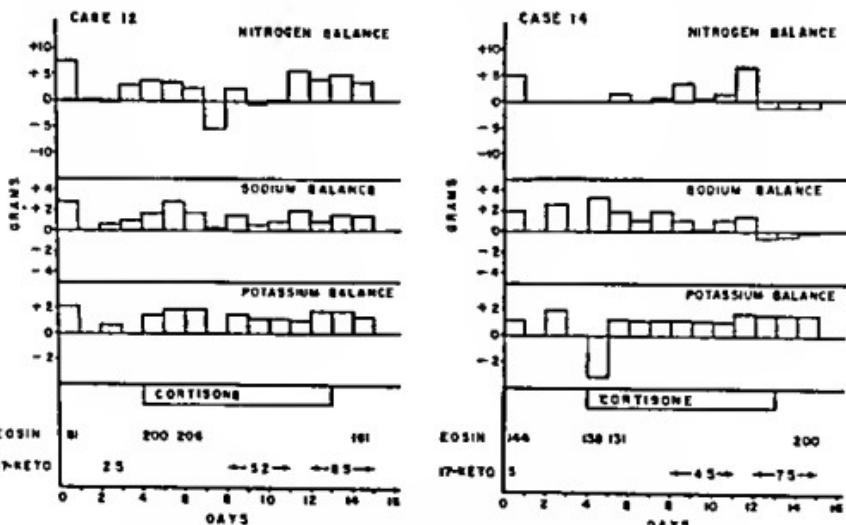


Figure 2. Studies of two cortisone-treated patients.

and severe pain for from 3 to 7 days. The final stage is gangrene of the involved tissue which then proceeds to form a line of demarcation.

In the treatment of frostbite, recognition of the early signs and prevention of injury are important. After the injury has developed, the optimum therapy appears to be exposure of the part in dry air at 70° F., with no local heating measures. The use of heparin appears to be of some value during the first few hours of injury when agglutinative thrombi theoretically might be prevented. In the later stages, Buerger's exercises and use of the part appear to be beneficial. Amputation should be delayed until the gangrene is well demarcated.

This hospital received 586 patients from Korea with frostbite, many of whom had complicating wounds. Many of these patients were transferred to hospitals near their homes. Inasmuch as no satisfactory treatment for frostbite in the stage after rewarming was available, the Metabolic Research Facility undertook to make observations on the effects of cortisone.

*Material and methods.* A project was set up to administer cortisone to a group of 8 patients and to use 8 other untreated patients as controls. All patients were placed on a standard diet with a fixed calculated intake of calories, nitrogen, sodium, potassium, and phosphorus. Balance studies were conducted on these elements. Antibiotics were used when indicated and physical activity about the ward was encouraged. The treated patients and controls were "paired" as to severity of injury insofar as possible. The treated group of patients received 100 mg. of cortisone in one intramuscular dose daily. Because no satisfactory placebo was found, none was used in the untreated group. Table 1 gives the ages of the patients, duration of injury, and describes the extent of involvement of the treated and control groups.

*Results.* No significant clinical effect of cortisone was noted on the progress of frostbite injury at the stage in which the agent was used. Figures 1 and 2 show the results obtained from balance studies on urinary nitrogen, sodium, and potassium; and observations on the circulating eosinophil count, and urinary 17-ketosteroids in representative patients in each group. No significant metabolic effects were noted in the treated group.

# Observations on Essentially Normal Young Men Treated With ACTH and Cortisone<sup>(1, 2)</sup>

## II. Effects on Tuberculin, Dick, and Schick Tests

Saul B. Appel, Major, MC, U. S. A.

Lyman A. Fulton, Lieutenant, junior grade, MC, U. S. N. R.

Kenneth D. Orr, Lieutenant Colonel, MC, U. S. A.

**R**EPORTS on the effects of ACTH and cortisone on the tuberculin test disagree. Some investigators described inhibition in man (3-5), in tuberculous guinea pigs (6), and in hyperimmune guinea pigs (7, 8); others have noted no inhibition in tuberculous guinea pigs (9) and possibly increased severity of the reaction in tuberculous guinea pigs (10). During our study of the effects of ACTH and cortisone on the healing of frostbite lesions, an opportunity was afforded for studying the response of these subjects to tuberculin, Dick, and Schick tests.

(1) From the Cold Injury Section, Osakis Army Hospital.

(2) The second of three articles on this subject. The statistical analyses were made by H. M. C. Luykx, D. Sc.

(3) Thorne, G. W., Forsham, P. H.; Frawley, T. F., Hill, S. R., Jr.; Roche, M.; Staebelin, D., and Wilson, D. L.: Clinical usefulness of ACTH and cortisone. New England J Med. 242: 783-793, May 18, 1950.

(4) Long, J. B., and Favout, C. B.: Ability of ACTH and cortisone to alter delayed type bacterial hypersensitivity. Bull. Johns Hopkins Hosp. 87: 186-202, Sept. 1950.

(5) Fischel, E. E.: Relationship of adrenal cortical activity to immunity responses. Bull. New York Acad. Med. 26: 255-260, Apr. 1950.

(6) Derbes, V. J.; Dent, J. H.; Weaver, N. K.; Vaughan, D. D.: Response of tuberculin skin test to ACTH and cortisone in tuberculous guinea pigs. Proc. Soc. Exptl. Biol. & Med. 75: 423-426, Nov. 1950.

(7) Osgood, C. K., and Favout, C. B.: Personal communication to Thorne, G. W. et al. See reference footnote (3).

(8) Stoerk, H. C.: Inhibition of tuberculin reaction by cortisone in vaccinated guinea pigs. Federation Proc. 9: 345, 1950.

(9) Sheldon, W. H., Cummings, M. M.; and Evans, L. D.: Failure of ACTH or cortisone to suppress tuberculin skin reaction in tuberculous guinea pigs. Proc. Soc. Exptl. Biol. & Med. 75: 616-618, Nov. 1950.

(10) Spisin, D. M., and Molomur, N.: Effects of cortisone on development of tuberculous lesions in guinea pigs and on their modification by streptomycin therapy. Am. Rev. Tuberc. 62: 337-344, Oct. 1950.

## TUBERCULIN TEST

**Method.** As previously described (11) the subjects were patients with frostbite lesions localized in the toes, fingers, or heels. The ACTH group consisted of 13 subjects, the cortisone group of 22 and the control group of 26. The distribution of white and Negro troops was random and, when analyzed separately, showed no significant difference in incidence and in reaction. There was no significant difference among the 3 groups relative to time in hospital or duration of hormone therapy prior to the skin tests, which were performed in all 3 groups on the same days.

Twenty mg. of ACTH was administered intravenously in one liter of normal saline solution or 5 percent dextrose in water daily for 31 consecutive days. The infusion lasted about 6 hours. Cortisone was administered orally as follows: 400 mg. (100 mg. every 6 hours) on the first day; 300 mg. (75 mg. every 6 hours) on the second day; and 200 mg. daily (50 mg. every 6 hours) until the twelfth day, at which time 200 mg. (100 mg. at 0500 and at 2000) was given daily through the thirty-first day.

TABLE I. *Tuberculin test on twenty-fifth day of therapy*

Group	Number	Negative	Positive		1 plus	2 plus	3 plus	4 plus
			Number	Percent				
ACTH	13	4	9	69	2	4	2	1
Cortisone	22	7	15	68	2	3	8	2
Control	26	9	17	65	1	4	11	1

Second strength tuberculin (0.005 mg. PPD) in 0.1 ml. was injected intradermally in the right forearm. The reaction was measured at 48 hours and classified as follows:

Negative - Induration and erythema less than 5 mm. in diameter.

Positive - One-plus induration and erythema 5 to 10 mm. in diameter.

Two-plus induration and erythema 11 to 20 mm. in diameter.

Three-plus induration and erythema over 20 mm. in diameter.

Four-plus induration, erythema and necrosis; lesion over 20 mm. in diameter.

(11) Appel, S. B., and Orr, K. D.: Observations on essentially normal young men treated with ACTH and cortisone. I. Effects on glucose metabolism. U. S. Armed Forces M. J. 3: 207-220, Feb. 1952.

**Results.** Table 1 shows the results of the tuberculin tests on the twenty-fifth day of therapy as measured at 48 hours. There was no significant difference between the combined ACTH and cortisone groups compared with the control group (the critical ratio was 0.26; P was 0.8). Roentgenograms of the chest of all the subjects were normal. There was no past personal history of tuberculosis in any subject. Two control subjects had tuberculous mothers, and both of them exhibited 3-plus reactions. Because of the frequency of strongly positive, slowly resorbing reactions in all groups, a second test was performed on the twenty-first day after cessation of therapy only in those subjects with previously negative reactions. In the ACTH group 3 were negative and 1 was one plus. In the cortisone group 5 were negative, 1 was one plus, and 1 was two plus. In the control group 4 were negative and 1 was one plus. This degree of change is not significant (12, 13).

#### DICK TEST

**Method.** The subjects were the same as described previously except for variations mentioned below. One-tenth milliliter of diluted scarlet fever streptococcus toxin was injected intradermally in the right forearm. A control solution was prepared by heating a vial of the same preparation at about 96° C. for 45 minutes (14), and 0.1 ml. was injected intradermally in the left forearm. The reactions were observed and measured between 20 and 24 hours after injection and classified as follows:

Negative: Erythema in test arm less than 10 mm. in any diameter.

Negative with pseudo-reaction: Erythema in test and control arm, both being greater than 10 mm. in any diameter and of about equal magnitude.

Positive: Erythema in test arm greater than 10 mm. with control arm erythema less than 10 mm.

Positive with pseudo-reaction: Erythema in both arms greater than 10 mm. but much larger in the test arm as compared to the control arm.

**Results.** In the ACTH group (table 2) 11 subjects were tested on the twelfth day of therapy and on the ninth day after therapy and 2 subjects were tested only once (on the twenty-third and twenty-fifth days of therapy respectively). On the ninth day after therapy (table 5) the three positive reactors were positive-pseudo, negative, and negative-pseudo. The other 8 subjects showed no change. No negative reactor

(12) Cripe, L. H.; Levine, M. I.; and Aaron, T. H.: Inhibition of tuberculin type reaction by antihistaminic drugs and rutin. Am. Rev. Tuberc. 59: 701-706, June 1949.

(13) Ellison, R. T.: Clinical studies on allergy to tuberculin following primary tuberculous infection; clinical value of recognizing state of secondary negative allergy. Am. Rev. Tuberc. 58: 463-475, Oct. 1948.

(14) Topley, W. W. C., and Wilson, G. S.: Topley and Wilson's Principles of Bacteriology and Immunity. 3d edition (revised by G. S. Wilson and A. A. Miles). The Williams and Wilkins Co., Baltimore, Md., 1946. vol. II, p. 1457.

TABLE 2. Dick test ACTH group\*

Subject	On 12th day of therapy		9 days after therapy		Interpretation	
	Treat (mm.)	Control (mm.)	Interpretation	Test (mm.)	Control (mm.)	
1	12 by 12	5 by 5	Positive	15 by 15	10 by 10	Pos.-Pseudo**
2	12 by 12	3 by 3	Positive	9 by 8	9 by 7	Negative
3	0	0	Negative	0	0	Negative
4	0	0	Negative	4 by 3	0	Negative
5	13 by 13	12 by 12	Neg.-Pseudo	12 by 12	15 by 15	Neg.-Pseudo
6	11 by 11	0	Positive	12 by 11	14 by 12	Neg.-Pseudo
7	0	0	Negative	0	0	Negative
8	0	0	Negative	0	0	Negative
9	0	0	Negative	0	0	Negative
10	20 by 15	10 by 10	Pos.-Pseudo	23 by 20	15 by 14	Pos.-Pseudo
11	0	0	Negative	0	0	Negative**

\*Two subjects not included here were tested once on the twenty-third and twenty-fifth days respectively with negative reaction.

\*\*The eosinopenic effect striking ACTH latently at the time of this test was not over 50 percent.

became positive. Three subjects responded to an intravenous infusion of ACTH on the tenth day *after* therapy with an eosinopenia of less than 50 percent (11).

In the cortisone group (table 3) 20 subjects were tested at the same time intervals described above. Because 12 subjects exhibited an eosinopenia of less than 50 percent at the time of the second test after an infusion of ACTH (11) the Dick test was repeated 1 week later. At this time only 6 subjects showed an eosinopenia of less than 50 percent. Of 2 initially positive reactors, 1 became negative-pseudo and of 15 negative reactors, 1 became positive and 2 negative-pseudo (table 5).

In the control group (table 4) 23 subjects were tested twice; 18 other subjects were chosen at random from available patients with similar mild frostbite lesions and were tested once. Two had a frankly positive reaction; 4 had positive-pseudo reactions; 33 negative; and 5 negative-pseudo reactions. Of 21 negative reactors retested 1 became positive; 1 positive-pseudo; and 1 negative-pseudo. If the positive and positive-pseudo reactions are classified as positive and the negative and negative-pseudo reactions as negative, no significant difference was observed between the ACTH and control group (the critical ratio was 1.6; P was 0.11). There was no significant difference between the combined ACTH and cortisone group compared with the control group (the critical ratio was 1.04; P was 0.32).

#### SCHICK TEST

*Method.* The subjects were those described previously. One-tenth milliliter of diluted diphtheria toxin stabilized with buffer was injected intradermally in the right forearm and 0.1 ml. of Schick test control solution (heat buffer toxin) was injected intradermally in the left forearm. Reactions were observed and measured at 3, 4, and 7 days. They were classified as in the Dick test. As in the tuberculin and Dick tests, the Schick tests were performed by the same investigators on the same day on all subjects and were interpreted by the same observers.

*Results.* In the ACTH group on the sixteenth day of therapy 11 subjects were Schick tested; 3 showed positive reaction (table 6). Ten days *after* therapy one initially positive reactor was negative. At this time 3 subjects had an eosinopenia of less than 50 percent after ACTH was given intravenously (11).

In the cortisone group 20 subjects were tested on the sixteenth day of therapy and 10 days *after* therapy (table 7). At the time of the second test 12 subjects had an eosinopenia of less than 50 percent after ACTH was given intravenously (11). Therefore, the entire group was retested 20 days after discontinuing the cortisone therapy. At the time of this test, 6 subjects had an eosinopenia of less than 50 percent. Subjects 15, 29, and 30 showed changes from positive to negative, negative to positive, and negative to negative-pseudo, respectively.

TABLE 3. Dick test, eosinopenia group\*

Subject	On 12th day of therapy			9 days after therapy			18 days after therapy		
	Test (mm.)	Control (mm.)	Interpretation	Test (mm.)	Control (mm.)	Interpretation	Test (mm.)	Control (mm.)	Interpretation
12	0	0	Negative	0	0	Negative**	0	0	Negative**
13	13 by 12	12 by 10	Neg.-Pseudo	12 by 9	10 by 10	Neg.-Pseudo	15 by 12	15 by 10	Neg.-Pseudo**
14	11 by 8	8 by 8	Negative	16 by 12	0	Positive	15 by 15	10 by 10	Pos.-Pseudo
15	0	0	Negative	12 by 12	11 by 9	Neg.-Pseudo**	0	0	Negative
16	0	0	Negative	0	0	Negative	0	0	Negative
17	0	0	Negative	0	0	12 by 10	?	0	Negative**
18	0	0	Negative	0	0	10 by 8	?	0	Negative
19	0	0	Negative	0	0	Negative	0	0	Negative
20	0	0	Negative	0	0	Negative	0	0	Negative
21	0	0	Negative	11 by 9	0	Positive**	0	0	Negative**
22	32 by 20	25 by 24	Neg.-Pseudo	30 by 30	15 by 10	Pos.-Pseudo	25 by 20	30 by 25	Neg.-Pseudo
23	15 by 15	8 by 8	Positive	15 by 14	6 by 6	Positive**	15 by 14	8 by 8	Positive
24	0	0	Negative	11 by 10	3 by 2	Positive**	0	0	Negative
25	0	0	Negative	8 by 8	0	Negative**	15 by 11	5 by 5	Positive
26	22 by 18	13 by 10	Pos.-Pseudo	30 by 26	22 by 20	Pos.-Pseudo**	25 by 20	12 by 10	Pos.-Pseudo
27	0	0	Negative	8 by 5	0	Negative**	0	0	Negative**
28	0	0	Negative	0	0	Negative**	0	0	Negative**
29	0	0	Negative	15 by 15	15 by 15	Neg.-Pseudo**	15 by 12	10 by 7	Neg.-Pseudo
30	15 by 15	6 by 6	Positive	18 by 15	18 by 15	Neg.-Pseudo**	12 by 11	12 by 10	Neg.-Pseudo
31	0	0	Negative	6 by 4	0	Negative**	0	0	Negative**

\* Two subjects not included here were tested once on the twenty-seventh and twenty-eighth day of therapy with following reactions respectively:

30 by 28 and 34 by 26 (neg.-pseudo) and 8 by 8 and 2 by 2 (pos.).

\*\* Eosinopenia after giving ACTH intravenously at the time of this test was not over 50 percent.

TABLE 4. *Dick test; control group*

Subject	On 12th day of therapy			9 days after therapy		
	Test (mm.)	Control (mm.)	Interpretation	Test (mm.)	Control (mm.)	Interpretation
32	0	0	Negative	0	0	Negative
33	—	—	—	11 by 10	0	Positive
34-38	0	0	Negative	0	0	Negative
39	0	0	Negative	0	6 by 6	Negative
40	50 by 30	17 by 14	Pos.-Pseudo	15 by 15	10 by 10	Pos.-Pseudo
41,42	0	0	Negative	0	0	Negative
43	6 by 6	8 by 8	Negative	20 by 12	12 by 11	Pos.-Pseudo
44	0	0	Negative	0	0	Negative
45	0	0	Negative	3 by 3	0	Negative
46	0	0	Negative	0	0	Negative
47	20 by 18	18 by 15	Neg.-Pseudo	22 by 15	20 by 20	Neg.-Pseudo
48-50	0	0	Negative	0	0	Negative
51	0	0	Negative	10 by 8	2 by 1	Positive
52	0	0	Negative	12 by 10	10 by 10	Neg.-Pseudo
53-55	0	0	Negative	0	0	Negative
61	—	—	—	—	—	Negative
62	—	—	—	15 by 15	15 by 12	Neg.-Pseudo
63-66	—	—	—	0	0	Negative
67	—	—	—	20 by 17	10 by 10	Pos.-Pseudo
68	—	—	—	10 by 10	10 by 8	Neg.-Pseudo
69-73	—	—	—	0	0	Negative
74	—	—	—	25 by 20	18 by 15	Pos.-Pseudo
75	—	—	—	20 by 20	15 by 13	Pos.-Pseudo
76,77	—	—	—	0	0	Negative

TABLE 5. Summary of results of Dick test

ACTH group	During therapy		9 days after therapy			
	Interpretation	Number	Positive	Positive Pseudo	Negative	Negative Pseudo
Cortisone group	Positive	3	-	1	1	1
	Pos.-Pseudo	1	-	1	-	-
	Negative	8*	-	-	6	-
	Neg.-Pseudo	1	-	-	-	1
	Total	13	-	2	7	2
Control group***	18 days after therapy					
	Positive	2	1	-	-	1
	Pos.-Pseudo	1	-	1	-	-
	Negative	15	1	1	12**	1
	Neg.-Pseudo	2	-	-	-	2
	Total	20	2	2	12	4
Control group***	9 days after therapy					
	Positive	0	-	-	-	-
	Pos.-Pseudo	1	-	1	-	-
	Negative	21	1	2	18	-
	Neg.-Pseudo	1	-	-	-	1
	Total	23	1	3	18	1

\*Two subjects were tested only once (i. e. during therapy).

\*\*Six subjects did not demonstrate eosinopenia of over 50 percent after ACTH was given intravenously at the time of this test.

\*\*\*Eighteen subjects were tested only once.

In the control group 24 subjects were tested twice, and 16 additional patients with similar mild firstbite lesions selected at random were tested once (table 8). In 2 the reaction changed from negative to positive-pseudo, and in 3 from positive to negative. The results of the Schick test are summarized in table 9.

Statistical examination of the Schick test results indicates: (1) no significant difference in the initial tests comparing the ACTH group alone with the control group (the critical ratio was 0.57; P was 0.40); (2) no significant difference in the initial tests when the hormone groups were combined and compared with the control group (the critical ratio was 1.6; P was 0.11), (3) no significant difference in the frequency of

changes in reaction in the ACTH as compared with the control group (the critical ratio was 0.92;  $P$  was 0.37); and (4) no significant difference in the frequency of changes in reaction of the combined hormone groups as compared with the control group (the critical ratio was 1.75;  $P$  was 0.07).

TABLE 6 Schick test: ACTH group

Subject	On 16th day of therapy			10 days after therapy		
	Test (mm.)	Control (mm.)	Interpretation	Test (mm.)	Control (mm.)	Interpretation
1	12 by 10	0	Positive	14 by 13	0	Positive*
2-6	0	0	Negative	0	0	Negative
7	0	0	Negative	0	0	Negative*
8	0	0	Negative	0	0	Negative
9	10 by 10	0	Positive	12 by 11	0	Positive
10	14 by 14	0	Positive	0	0	Negative
11	0	0	Negative	0	0	Negative*

\*Eosinopenia after giving ACTH intravenously at the time of this test was not over 50 percent.

### DISCUSSION

That satisfactory adrenocortical stimulation was achieved is evident in the studies of eosinopenia following both ACTH and cortisone (11). As reported elsewhere (11, 15), the ACTH group exhibited side-effects consistent with hypoadrenocorticism, although the time of actual stimulation provided by the intravenous technic of ACTH administration was probably not greater than 8 hours daily (11).

The reported incidence of a positive tuberculin reaction in man has varied widely among observers mainly because of differences in environment (rural versus urban) and age of the subjects studied (16). The remarkable similarity in reaction in the subject groups of this paper indicates that from 65 to 70 percent of troops show a positive reaction to the second strength tuberculin test.

The tuberculin type reaction, involving the neutralization of endotoxins (17), represents a special class of hypersensitivity reaction inasmuch as the tissue cells themselves seem to be the site of the

(15) Appel, S. B., Fulton, L. A.; and Ott, K. D.: Observations on essentially normal young men treated with ACTH and cortisone. III. Side-effects during therapy. To be published.

(16) Sweany, H. C.: Tuberculin test, its use, limitations and future possibilities in diagnosis. Am. Rev. Tuberc. 56: 135-156, Aug. 1947.

(17) Ratner, B.: Allergy, Anaphylaxis and Immunotherapy; Basic Principles and Practice. The Williams and Wilkins Co., Baltimore, Md., 1943. p. 44.

TABLE 7. Schick test: cortisone group\*

Subject	On 16th day of therapy		10 days after therapy		20 days after therapy		Control (mm.)	Test (mm.)	Interpretation
	Test (mm.)	Control (mm.)	Test (mm.)	Control (mm.)	Test (mm.)	Control (mm.)			
12-14	0	0	Negative	0	0	0	0	0	Negative
15	12 by 12	0	Positive	15 by 15	12 by 12	Neg-Pseudo	0	0	Negative
16-18	0	0	Negative	0	0	Negative	0	0	Negative
19	0	0	Negative	5 by 5	0	Negative	0	0	Negative
20	0	0	Negative	0	0	Negative	0	0	Negative
21	0	0	Negative	8 by 8	0	Negative	0	0	Negative
22	0	0	Negative	0	0	Negative	0	0	Negative
23	10 by 10	0	Positive	0	0	Negative	11 by 10	8 by 8	Positive
24,25	0	0	Negative	0	0	Negative	0	0	Negative
26	10 by 10	0	Positive	0	0	Negative	0	0	Negative
27,28	0	0	Negative	0	0	Negative	0	0	Negative
29	0	0	Negative	10 by 8	8 by 8	Positive	—	—	—
30	0	0	Negative	6 by 6	6 by 4	Negative	15 by 10	12 by 10	Neg-Pseudo
31	0	0	Negative	0	0	Negative	0	0	Negative

\*On the tenth day after therapy as eosinopenia of over 50 percent was not demonstrated by subjects 12, 15, 17, 21, 23-28, and 30, 31. On the seventeenth day after therapy such as eosinopenia was not demonstrated by subjects 12, 17, 21, 27, 28 and 31.

TABLE 8. Schick test; control group

Subject	On 16th day of therapy			10 days after therapy		
	Test, (mm.)	Control (mm.)	Interpretation	Test (mm.)	Control (mm.)	Interpretation
32	0	0	Negative	0	0	Negative
33	12 by 11	0	Positive	10 by 8	8 by 6	Positive
34	0	0	Negative	20 by 15	10 by 10	Pos.-Pseudo
35	0	0	Negative	0	0	Negative
36	15 by 12	0	Positive	0	8 by 6	Negative
37	3 by 3	3 by 3	Negative	5 by 5	8 by 6	Negative
38	0	0	Negative	0	0	Negative
39	12 by 11	0	Positive	15 by 10	0	Positive
40	8 by 8	0	Negative	0	0	Negative
41	12 by 11	0	Positive	0	0	Negative
42, 43	0	0	Negative	0	0	Negative
44	0	0	Negative	8 by 8	4 by 4	Negative
45	15 by 15	0	Positive	14 by 12	0	Positive
46	15 by 14	0	Positive	13 by 12	0	Positive
47	10 by 10	0	Positive	0	0	Negative
48	25 by 20	0	Positive	16 by 15	0	Positive
49	0	0	Negative	0	0	Negative
50	25 by 18	0	Positive	26 by 22	0	Positive
51	0	0	Negative	0	0	Negative
52	0	0	Negative	6 by 6	6 by 5	Negative
53, 54	0	0	Negative	0	0	Negative
55	0	0	Negative	30 by 20	15 by 12	Pos.-Pseudo
68	—	—	—	0	6 by 8	Negative
69	—	—	—	30 by 25	0	Positive
70	—	—	—	14 by 12	0	Positive
71-73	—	—	—	0	0	Negative
74	—	—	—	14 by 8	0	Positive
75	—	—	—	0	0	Negative
76	—	—	—	10 by 8	0	Positive
77, 78	—	—	—	0	0	Negative
79	—	—	—	11 by 8	0	Positive
80-82	—	—	—	0	0	Negative
83	—	—	—	24 by 22	0	Positive

antigen and no humoral antibodies are found (18). Studies were made of the Dick and Schick tests, involving the neutralization of exotoxins (17), wherein the concentrations of humoral antibodies are invoked. The incidence of negative Dick tests in subjects of the age group observed here may be estimated as from 70 to 80 percent (19). The incidence observed in this study (from 69 to 88 percent) appears somewhat higher

(18) Harvey, A. M.: Introduction to series of papers on studies on ACTH and cortisone. Bull. Johns Hopkins Hosp. 87: 349-353, Nov. 1950.

(19) Ratner, B.: See reference footnote (17), p. 306.

TABLE 9. Summary of results of Schick tests

ACTH group	During therapy		10 days after therapy			
	Interpretation	Number	Positive	Positive Pseudo	Negative	Negative Pseudo
	Positive	3	2		1	
	Negative	8			8	
	Total	11	2		9	
Cortisone group	20 days after therapy					
	Positive	3	1		2	
	Negative	17	1*		15**	1
	Total	20	2		17	1
Control group***	10 days after therapy					
	Positive	9	6		3	
	Negative	15		2	13	
	Total	24	6	2	16	

\*Subject 29 became positive 10 days after therapy and was not available for retesting.

\*\*6 subjects did not show an eosinopenia of over 50 percent after ACTH was given intravenously at the time of this test.

\*\*\*16 subjects were tested only once.

and may reflect the high incidence of beta-hemolytic streptococcal infections in the Far East. The incidence of negative reactions to the Schick test was reported (in 1924) to be about 90 percent in adults (20). The slightly lower incidence (from 63 to 85 percent) demonstrated by the present study may be a reflection of differences in Schick test toxin, the wide range of antitoxin concentration producing a negative reaction (21), or the decline of diphtheria in the past 27 years.

### CONCLUSION

In a controlled study of the effects of ACTH and cortisone on the tuberculin, Ouchterlony, and Schick tests in essentially normal young men no statistically significant differences were noted between the reactions during and after therapy. No alteration in the frequency of pseudo-reaction hypersensitivity to the Dick and Schick control solutions was observed.

(20) Park, W. D., and Ziegler, A.: See reference footnote (17), p. 171.

(21) Marshall, M. S.: Bordet-Gengou Schick test. *J. Pediat.*, 37, 620-625, Oct. 1950.

# Treatment of Periodontal Disease

Julius N. Obin, Captain, U. S. A. F. (DC)

A SUCCESSFUL treatment plan for the cure of periodontal disease involves: (1) removal of the cause, (2) removal of the effects produced, and (3) increasing tissue resistance to prevent recurrence. Frequently, conservative therapy fails to accomplish these results. This is usually due to lack of recognition and hence failure to remove all the causative factors. Because periodontal disease is the result of a combination of causes rather than any single cause, a thorough examination and complete diagnosis are essential. This should include a full series of radiographs and bite-wings, study models and an evaluation of all phases of the case. Some of the more common causative factors are occlusal trauma, poor oral hygiene, deficient nutrition, emotional tension, and systemic disease (table 1).

TABLE 1. *Systemic disease which may cause periodontal disease*

Faulty nutrition.

Debilitating diseases which lower body resistances:

- Syphilis
- Nephritis
- Tuberculosis
- Gastrointestinal disorders

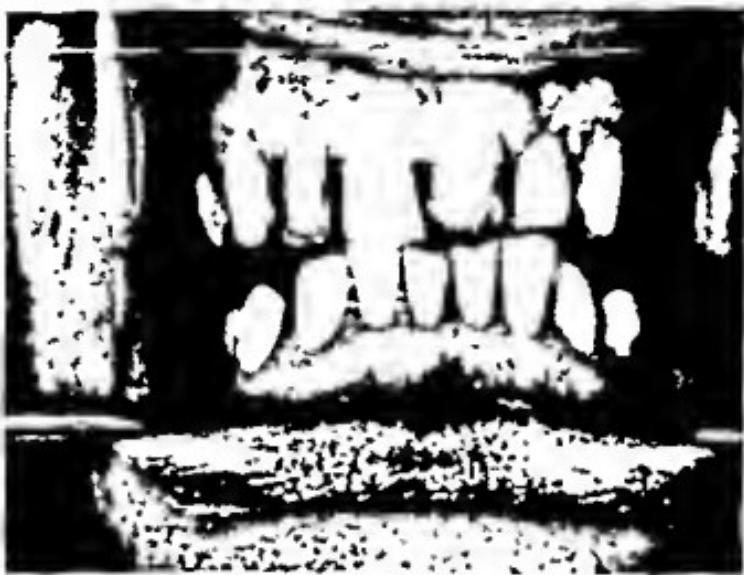
Blood dyscrasias:

- Anemia
- Purpura
- Polycythemia
- Leukemia
- Granulocytopenia

Endocrine dysfunction:

- Pituitary disorders
- Diabetes mellitus
- Parathyroid disturbances
- Adrenal hypofunction

Occlusal trauma frequently can be corrected by the equilibration of the natural teeth (figs. 1 and 2). The aim of such a procedure is to achieve simultaneous contact between as many teeth as possible, not only in centric occlusion, but also in the protrusive position and



*Figure 1. Traumatic relation in protrusive position.*

protrusive and lateral excursions. This correction can also be achieved to a great extent by orthodontic techniques and when possible this is the treatment of choice. Proper restorative dentistry is another method of reducing occlusal trauma. Combinations of these techniques may be used.

**Poor oral hygiene.** Proper massage (preferably the modified Stillman method or, if the interproximate tissues are already destroyed, the Charters method) after the removal of irritating factors is the most frequently overlooked factor in the successful treatment of periodontal



*Figure 2. Correction of protrusive trauma. Note increased number of teeth in contact.*

disease. Time should be expended in the teaching of gingival massage. A patient who is taught to massage effectively will rarely have a recurrence of gingival disease.

**Nutrition.** In addition to the minerals and vitamins in the foods, their detergent nature must be considered. Diets which emphasize refined carbohydrates as well as soft nonstimulating foods, lead to caries, poor gingival tone, and calculus deposits. Such foods do little to stimulate gingival circulation and functional hygiene. Unfortunately these are common fare with most patients. Vitamin supplements should be prescribed not only for their effect on gingival health but also as a means of improving gingival capillary tone and tissue texture.



Figure 3. Use of interproximal stimulator.

The most frequently seen effects of periodontal disease are: ulatropy (gingival recession), gingivitis, alveoloclasia, and pericementoclasia (pocket formation).

Too frequently, attempts are made to remove the symptoms rather than the cause. This may give temporary relief but the condition will usually recur. The use of penicillin to eliminate the signs of acute necrotizing ulcerative gingivitis is an example of treating symptoms without attempting to treat the cause of the disease. Another common method of treating necrotizing ulcerative gingivitis is the use of chromic acid solutions. The application of this severe caustic material cannot be recommended because of the resulting tissue destruction.

Gingivectomy without any other treatment should be discouraged. In most cases, pocket elimination is temporary because the underlying conditions creating the pockets, if not removed, will permit the formation of new areas of infection. In selected patients gingivectomy may be indicated but its routine use frequently results in an unesthetic appearance.

This building up of tissue resistance to prevent recurrence of gingival disease is often neglected. The patient should be encouraged in the proper and frequent use of the toothbrush and interproximal stimulator (fig. 3) because the dramatic results which follow conscientious application well repay the effort expended in its teaching and practice.

Steps in the treatment of periodontal disease, after a diagnosis based on a complete examination has been made, should consist of, (1) scaling, (2) instruction in massage, (3) dietary advice, (4) occlusal equilibration, (5) subgingival curettage, (6) polishing with a porto-polisher, and (7) surgical procedures where indicated.

Adherence to these basic principles in the treatment of periodontal disease will give results of a permanent nature and will result in a lasting cure.

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### BOOK REVIEW

*Prosthetic Dentistry, A Clinical Outline*, by F. Winston Craddock, B. A., Dip. Ed., Cert. Dent. (N. Z.), M. S. D. (Northwestern), Head of the Department of Prosthetic Dentistry, University of Otago Dental School, Dunedin, New Zealand. 2d edition revised and enlarged. 363 pages, 179 illustrated. The C. V. Mosby Co., St. Louis, Mo., publisher, 1951. Price \$6.75.

The second edition of this outline of prosthetic dentistry is a compactly written text that effectively reviews the fundamental principles of full and partial denture construction. In the revision of the preceding edition, which was printed in 1945, a new section on surgical preparation of the mouth from the prosthodontist's viewpoint is included and there is a discussion of splints that should be of interest to the dentist in the military service. Throughout the text the author makes wide use of the large bibliography of standard sources which he lists at the end of the book. The introduction to each subject is accompanied by a clear definition of terms which are often a source of controversy because of the varied meanings given them by different writers. The discussion on full denture construction in general follows the procedures most widely accepted today without attempting to stress any particular technic and suggests variations according to the nature of the individual problem. Although the discussion of partial dentures is not as extensive, the information on clasp function and load distribution is helpful. The author recognizes the technical skill achieved by the profession in dental prosthesis and emphasizes the need for an adequate recognition of the complexities of the prosthetic problem from an anatomic and physiologic point of view. This book should be as useful to the practitioner as it is to the student.—*Lt. Col. B. W. Dunn, U. S. A. F. (DC)*

# Effects of Mobilization on 1950-1951 Residents and Interns at Approved Nonmilitary Hospitals as of 15 February 1951<sup>(1)</sup>

WHEN hostilities broke out in Korea, the manpower pool of physicians was estimated at 203,000. Of this number, 7,600 were on active military duty (2), another 32,000 reservists were potentially available for active military duty; and more than 163,000 or about 4 of every 5, were not liable for military service and neither actively nor inactively a part of the military medical corps. This distribution soon changed. Within a year, the number on active duty almost doubled, rising from 7,600 to 13,700 in June 1951. In October 1950 the 81st Congress enacted Public Law 779, the "doctor-draft" law, and the pre-Korea total of 32,000 physicians potentially available for military duty more than tripled; the number not liable for military service shrank from 163,000 to less than 77,000.

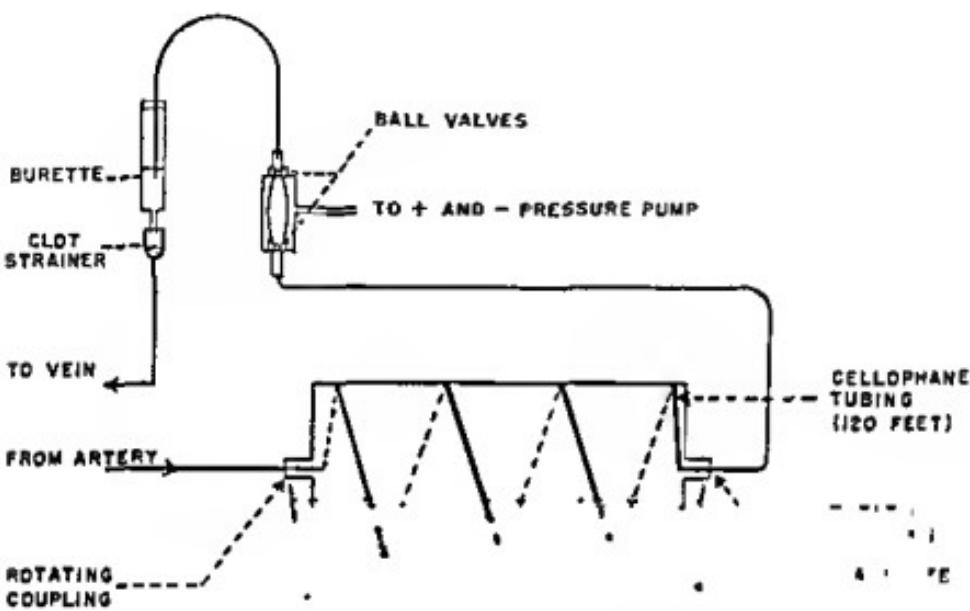
*Physicians on active duty.* About 6,000 physicians began their 24-month tour of duty in the Department of Defense during the first year of the Korean campaign. Three of every 10 were registrants under Public Law 779; the others were recalled reservists. About half of the registrants and reservists were in priority I and the balance were in priorities II, III, or IV, with most of them from priority IV, physicians with more than 21 months' service since 1941. Physicians potentially available for military service increased from 32,000 to a total of more than 114,000. The latter total included those of the 32,000 reservists not yet recalled to active duty (about 28,000) and about 86,500 registrants. The remaining physicians, men over 50 years of age, women, and aliens, were not liable for military service.

*Registrants total over 88,000.* About 88,400 physicians have registered in 1 of the 4 priority groups set up by Public Law 779. June figures from Selective Service showed 10,549 in priority I, about 2,500 in priority

(1) Condensed from a report prepared for the Health Resources Advisory Committee by the Health Resources Staff, Office of Defense Mobilization.

(2) In this report, physicians in the commissioned corps of the Public Health Service are considered as on active military duty.

intoxication. The diffusion process naturally reduces the concentration gradients between the normal concentrations of the dialysate bath constituents and their abnormal concentrations in the patient's plasma. Hence, the bath is emptied and reconstituted at suitable intervals during the procedure.



*Figure 1. Circuit diagram of artificial kidney.*

Heparin in the amount of about 150 mg. in 6 hours is given to prevent blood coagulation during the dialysis. Protamine sulfate is given intravenously at the conclusion to restore the blood coagulation time to normal. Dialysis is usually carried on for 6 hours. The blood pressure, pulse, and respiratory rate are taken every 15 minutes and recorded graphically by the nurse in attendance, who also administers regular nursing care as the dialysis proceeds.

#### USING THE ARTIFICIAL KIDNEY: ACUTE RENAL INSUFFICIENCY

Acute renal insufficiency as manifested by anuria or severe oliguria and the symptoms of acute uremia occur in a wide variety of circumstances, some of obvious military significance, and all of clinical importance. Military personnel, including battle casualties, may develop oliguria or anuria following (1) burns, (2) crush injuries, (3) sulfonamide administration, (4) mercuric chloride and carbon tetrachloride poisoning, (5) transfusion reactions, (6) prolonged, severe hypotension, (7) acute glomerulonephritis, (8) ureteral instrumentation, or (9) severe hepatic

failure (5). Often a combination of such causes occurs in these patients. Frequently the causative injury is sustained under the superimposed stress of battle. Acute prostatic obstruction, severe sodium chloride depletion, and hemorrhagic shock are causes of oliguria or anuria which may be reversed by urethral catheterization, sodium chloride administration, or whole blood transfusion and do not properly belong to the foregoing group in which renal tubular lesions of varying type and degree are uniformly present.

TABLE I. *Dialysate bath*

Chemical constituents in 100 liters	Grams	Milliequivalents per liter of					
		Na	K	Mg	Ca	Cl	HCO <sub>3</sub>
NaCl	660	113				113	
NaHCO <sub>3</sub>	225	27					27
KCl	30		4			4	
MgCl <sub>2</sub> .6H <sub>2</sub> O	22			2		2	
CaCl <sub>2</sub> .2H <sub>2</sub> O	40				5	5	
Glucose	200						
Total		140	4	2	5	124	27
Normal plasma		142	5	3	5	103	27

These lesions correspond to the clinical oliguria or anuria which fails to respond with diuresis following the giving of fluids. Forcing fluids in an attempt to produce diuresis is regularly followed by peripheral and pulmonary edema and death in such patients.

The absence of functioning renal tissue accounts for the metabolic alterations of acute renal insufficiency. For practical purposes these may be grouped as follows: (1) azotemia, which reflects the failure of renal excretory function in disposing of metabolic end products; (2) metabolic acidosis, which reflects the failure of renal acid-base regulation; and (3) a tendency to potassium intoxication, which occurs in the presence of acidosis and azotemia, may cause sudden death from cardiac standstill, and therefore is a medical emergency.

### POTASSIUM INTOXICATION

Anuria eliminates the major route of potassium excretion. Tissue catabolism, due to starvation and the stress of illness, liberates intracellular potassium to the extracellular fluid. The presence of acidosis

(5) Lucke, B.: Lower nephron nephrosis (renal lesions of crush syndrome, of burns, transfusions, and other conditions affecting lower segments of nephrons). Mil. Surgeon 99: 371-396, Nov. 1946.

against fatal potassium intoxication by withholding potassium-containing fluids, suppressing tissue catabolism, and anticipating its sudden development.

In many patients conservative therapy alone will suffice and the patient may begin to form urine, frequently before the eleventh day. However, reversal of the chemical abnormalities by hemodialysis will frequently produce a marked clinical improvement, and transform a sick patient into an ambulatory patient who is not only more comfortable but able to eat.

### RESULTS OF DIALYSIS

Several brief case summaries serve to illustrate the results that may be expected.

**Case 1.** A 23-year-old man had acute glomerulonephritis, with oliguria for 2 weeks and complete anuria for 5 days prior to dialysis. The ECG revealed marked potassium intoxication. The plasma concentrations before and after dialysis are shown below. Determinations on dialysate

	Blood urea nitrogen (mg. per 100 ml.)	Creatinine (mg. per 100 ml.)	Milliequivalents per liter of			
			Na	K	CO <sub>2</sub>	Cl
Before	233	40	135	8.0	7.5	97
After	60	18	142	4.2	12.3	105

baths demonstrated the total removal of 93.7 grams of urea nitrogen, 127.4 grams of nonprotein nitrogen, and 380 milliequivalents of potassium. Within 24 hours after hemodialysis the patient had improved dramatically, was able to be out of bed and requested food which he tolerated well. During the following 9 days of continuing complete anuria, uremic symptoms gradually recurred, electrocardiographic signs of potassium intoxication reappeared and the patient was again dialyzed. The plasma concentrations before and after dialysis are shown below. The dialysate

	Blood urea nitrogen (mg. per 100 ml.)	Milliequivalents per liter of			
		Na	K	CO <sub>2</sub>	Cl
Before	230	135	6.3	19.1	106
After	70	146	4.1	20.2	109

showed the removal of 64.2 grams of urea nitrogen and 400 mEq. of potassium. Again a marked clinical improvement occurred. The patient remained anuric for 14 days following the second dialysis. He died suddenly as a third dialysis was being arranged. Autopsy revealed (1) bronchopneumonia of the middle and lower lobes of the right lung, (2) massive pulmonary edema, and (3) kidneys of normal size with the

granular surface and punctate hemorrhagic areas of acute glomerulonephritis (11).

**Case 2 (12).** A 71-year-old man with intravascular hemolysis produced by distilled water used as a bladder-irrigation fluid in a transurethral prostatectomy developed a hemoglobinuric nephrosis with oliguria 8 days prior to dialysis. The plasma concentrations before and after dialysis are shown below. The patient's good clinical response to dialysis was followed by a diuresis and ultimate recovery.

	Blood urea nitrogen (mg. per 100 ml.)	Milliequivalents per liter of			
		Na	K	CO <sub>2</sub>	Cl
Before	179	128	5.9	10.3	89
After	50	140	4.6	15.5	111

**Case 3 (12).** A 35-year-old woman had preeclampsia with premature separation of the placenta. This patient was oliguric. For 5 days before dialysis she passed less than 100 ml. of urine daily. The ECG showed evidence of potassium intoxication. The plasma concentrations before and after dialysis are shown below. This patient had a postdialysis diuresis with uneventful recovery.

	Blood urea nitrogen (mg. per 100 ml.)	Milliequivalents per liter of			
		Na	K	CO <sub>2</sub>	Cl
Before	137	113	9.5	11.8	83
After	63	129	5.0	18.2	104

#### OTHER INDICATIONS FOR DIALYSIS

**Barbiturate intoxication.** Patients who have ingested large doses, especially of the longer-acting barbiturates, become comatose and may develop hypotension and/or anuria. Renal clearance of barbiturates is poor. The renal tubules may reabsorb as much as 96 percent of the substance filtered at the glomeruli (13). Hemodialysis provides a means of removing large amounts of barbiturate from such patients, thus avoiding the hazards of prolonged coma.

**Salicylism.** Overdoses of salicylates represent another type of intoxication by a dialyzable substance in which striking benefit may be expected from hemodialysis (14).

(11) Microscopic examination not completed when this article was in preparation.

(12) Abstracted from medical records of Peter Bent Brigham Hospital, Boston, Mass., courtesy of Dr. J. P. Merrill.

(13) Swan, Dr. R. C.: Personal communication.

(14) Doolan, P. D.; Walsh, T. P.; Kyle, L. H.; and Wishinsky, H.: Acetylsalicylic acid intoxication. J. A. M. A. 146: 105-106, May 12, 1951.

*The oliguria and/or hypotension of severe hepatic failure.* Oliguria and auria in patients with hepatic failure also results in azotemia, acidosis, and potassium intoxication. Hypotension in these patients may respond dramatically to hemodialysis when all other measures have failed. Merrill et al. (4) recounts such an experience. Advantage is taken of the rise in blood pressure often recorded after about 2 hours of dialysis in any patient, regardless of his initial pressure.

*Hepatic coma without oliguria or hypotension.* Whether dialysis is of value in this condition is a matter of interest and requires investigation. In the absence of contraindications, and if the patient fails to respond to ordinary therapy, dialysis may be of benefit.

*Symptomatic exacerbations in chronic uremia.* Dehydration from any cause deprives the chronic uremic patient of his only real means of symptomatic and chemical control, that is, his ability to excrete a large volume of urine. His inability to concentrate urine under these circumstances results in sharp increases in azotemia and an intensification of symptoms. The resultant vomiting increases the dehydration and electrolyte abnormality. In such instances hemodialysis may be expected to restore the patient to his prior status.

*Surgery in chronic uremia.* Whereas an indwelling urethral catheter may help restore renal function after prolonged prostatic obstruction, circumstances may indicate or require an operation before azotemia has regressed. The operative risk involved may be lessened with a low level of azotemia.

### CONTRAINDICATIONS TO DIALYSIS

Only one absolute contraindication exists for hemodialysis and that is overt bleeding from any source. The total heparinization of each patient to prevent hemocoagulation in the dialyzer naturally will accentuate blood loss from any bleeding site. Although stools producing a 2 or 3 plus guaiac test do not contraindicate the procedure, they suggest an added risk. The studies of Merrill et al. (3, 4) indicate that such possible hazards as hemolysis, platelet lysis, or leukocyte destruction from trauma to these elements in traversing the dialyzer circuit, do not occur to any significant extent. Hematocrits determined at intervals fail to reveal hemochromogen in the supernatant plasma; and circulating leukocyte and platelet counts determined after dialysis show no significant changes from their predialysis levels.

### SUMMARY

Use of the artificial kidney is indicated for the correction of severe chemical abnormalities in patients with acute uremia. The clinical as well as the chemical improvement achieved by its use is striking. Potassium intoxication is a medical emergency and an absolute indication for dialysis. Although use of the artificial kidney is ordinarily not to be

considered lifesaving, the risk of losing a patient through potassium intoxication or other effects of uremic toxemia may thus be avoided. Other indications for hemodialysis include barbiturate intoxication, salicylism, hepatic coma with or without hypotension or oliguria, symptomatic exacerbations in chronic uremia, and its use as a preoperative measure in chronic uremia. Overt hemorrhage from any source is a contraindication to the use of the artificial kidney.

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## BOOK REVIEWS

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**Nutrition and Climatic Stress, With Particular Reference to Man,** by *H. H. Mitchell*, Professor of Animal Nutrition, University of Illinois, and *Marjorie Edman*, Research Assistant in Animal Nutrition in Charge of Literature Survey, University of Illinois, 234 pages, Charles C Thomas, Publisher, Springfield, Ill., 1951. Price \$6.75.

This comprehensive review of the literature was originally prepared by the authors under a contract between the University of Illinois and the Quartermaster Food and Container Institute for the Armed Forces. The value of this publication lies in the fact that the literature reviewed consists not only of that published in scientific periodicals but also in reports, many of which are obscure and not generally available. For this reason the extensive bibliography alone is of value. The material reviewed is divided into 3 broad categories: diet in a cold environment, diet in a hot environment, and diet at altitude. These 3 forms of stress are discussed in relation to the physiologic effects of the stress, the effect of the stress on nutritional requirements and the effect of diet on tolerance to the stress. Both animal and human experiments in this field are reviewed.—*Lt. Col. C. J. Koebn, MSC, U. S. A.*

**Physical Medicine and Rehabilitation for the Aged,** by *Walter S. McClellan*, M. D., Medical Director, The Saratoga Spa, Saratoga Springs, New York; Associate Professor of Medicine, Albany Medical College, Albany, N. Y. American Lecture Series Publication No. 105, A Monograph in American Lectures in Physical Medicine. 81 pages, illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1951. Price \$2.

This monograph on physical medicine has many shortcomings. The author attempts to cover the whole field of physical medicine and rehabilitation as related to the aged in 64 pages. As a result, no one phase of the subject is given sufficient space. For the specialist in physical medicine or for the physical therapist and occupational therapist, the book would be a mere primer. Doctor McClellan, an authority on spa therapy, presents the advantages of hydrotherapy in the treatment of degenerative disorders. Even this section, however, could be ex-

panded to advantage. I do not believe that this book has materially contributed to the field of physical medicine and rehabilitation and that the subject matter has been covered more completely in previously published texts.—*Lt. Col. J. N. Schaeffer, U. S. A. F. (MC)*

**Clinical Pathology of the Eye, A Practical Treatise of Histopathology,** by *Bernard Samuels, M. D.*, Emeritus Clinical Professor of Ophthalmology, Cornell University Medical College; Consulting Ophthalmologist, New York Hospital; Acting Advisory Surgeon and Consulting Pathologist, New York Eye and Ear Infirmary, and *Adalbert Fuchs, M. D., E. O. Professor of Ophthalmology, University of Vienna; Consulting Ophthalmologist and Pathologist, New York Eye and Ear Infirmary.* 420 pages; 418 illustrations, 191 in color. Paul B. Hoeber, Inc., New York, N. Y., publisher, 1952. Price \$20.

Aided by adequate numbers of plates and figures, the authors present in clear, concise writing the varied and diverse ocular lesions. In the first chapter important basic facts of pathology are reviewed, showing how they apply to the eye. In succeeding chapters the separate portions of the eye are taken up individually and the histopathologic findings are presented. The clinical aspects of each lesion are correlated with the anatomic changes. This, I believe, is the most valuable feature of the book. As an example, the section on retinal exudates is divided into groupings as noted clinically with the ophthalmoscope and the possible pathologic changes which will give such a picture are given. The last several chapters deal with such subjects as myopia, tuberculosis, post-operative complications, and injuries. The many possible lesions associated with each are discussed in detail. The section on postoperative complications is very well done and to the point. I wish it were more lengthy. The last chapter describes ocular tumors. The 44 color plates are excellent. Some have appeared previously in Fuchs' "Diseases of the Fundus Oculi," but this does not lessen their value. All plates, as well as figures, are accurate drawings rather than photographs. A number of controversial points, such as the cause of sympathetic ophthalmia, are well handled.—*Commander D. A. Mills, MC, U. S. N.*

From *A Doctor's Heart*, by *Eugene F. Snyder, M. D.*, with a foreword by *Paul Dudley White, M. D.* 251 pages; illustrated. Philosophical Library, New York, N. Y., publishers, 1951. Price \$3.75.

This book is the philosophic account of an episode of myocardial infarction suffered by the author, a physician. It describes the reactions of the patient, particularly those engendered by his physician, an eminent cardiologist, a psychiatrist friend, and a general practitioner. The author is a native of Russia who fled from the revolutionists to Czechoslovakia and later fled from the Nazis to this country. Much of the book is devoted to his viewpoint on these regimes and on the current international situation. The book is written for laymen and cannot be considered a scientific work.

—*Col. E. M. Goyette, MC, U. S. A.*

# Nongonococcal Urethritis<sup>(1)</sup>

Robert S. Graham, Lieutenant, junior grade, MC, U. S. N. R. (2)

OVER a year ago, the Venereal Disease Control Section of the infirmary at Camp Lejeune, N. C. became concerned with the large number of cases of urethral discharge (not due to gonorrhoea) in personnel at that station. Contrary to often expressed opinion, it soon became obvious that these were not cases of inadequately treated gonorrhoea. The literature at hand had little to offer in the way of explanation as to the cause or therapy. Conferences with other medical officers in the Navy, as well as in the other military services, revealed this problem to be widespread both in the United States and in the Far East. Information from the Bureau of Medicine and Surgery indicated that some activities had reported up to 3 percent of their total personnel had been treated for this condition in a single month. Some larger stations in the continental United States reported an incidence of this condition 3 times as high as that of gonorrhoea. As this had become one of our most perplexing problems in therapy and little was known about methods of control, a study of all such patients (totaling over 1,500) seen at the infirmary was begun.

There are many causes for a urethral discharge other than gonorrhoea. These were formerly classified under the general term, nonvenereal urethritis. From among these a condition which seems to be a definite entity clearly related to sexual exposure appears to be responsible for this increased incidence. It has a prolonged incubation period, is of long duration, is complicated by prostatitis, and responds to various therapeutic measures. The facts suggest the question: Are we dealing with a sixth venereal disease? It would appear that this disease became prevalent after penicillin came into general use. The relationship of penicillin and other antibiotics to this form of urethritis, if any, may well prove of interest.

## DIAGNOSIS

In order to identify and diagnose this particular form of urethritis, which we refer to as nongonococcal urethritis for lack of a more specific

(1) From the Preventive Medicine Division of the Bureau of Medicine and Surgery, Navy Department, Washington, D. C.

name, the other causes of urethral discharge with which it may be confused must be eliminated.

*Acute gonococcal urethritis* usually occurs from 3 to 5 days after intercourse with an infected person and is characterized by a burning sensation in the urethra on urination followed by a profuse purulent discharge. It is diagnosed by smear and culture and responds well to penicillin therapy.

*Urethral and prostatic infestations with Trichomas vaginalis* result in a burning sensation in the urethra and a mucopurulent or slightly blood-tinged discharge. It is diagnosed easily by identifying the parasite in suspensions of prostatic secretion, urinary sediment, and/or urethral discharge. This condition is prevalent enough to warrant examination for this parasite in all patients with urethral discharge not due to gonorrhea. A course of quinacrine should be given to such patients.

*Traumatic urethritis* produced by excessive sexual activity or "milking down" the urethra by those over-anxious persons who frequently check themselves for a urethral discharge. This discharge is usually sparse and may be seen as a "tear" on arising in the morning. It may be accompanied by urethral burning on urination. The discharge is frequently mucopurulent. This form of urethritis usually subsides in several days if the trauma to the urethra is discontinued. Smears and cultures are usually devoid of organisms. Although no therapy is indicated, these patients do need reassurance.

*Chemical urethritis* produced by intra-urethral prophylaxis is occasionally reported. This usually develops in from 12 to 24 hours and is characterized by a burning sensation and a slight discharge in which no organisms can be found. Such forms of urethritis clear fairly rapidly if the urethra is permitted to rest without further irritation.

*Normal urethral mucus.* Some men, stimulated by talks on venereal disease or by anxiety after promiscuous sexual exposure, closely inspect their sexual organ and discover for the first time the normal urethral mucus. In some it is more profuse than in others. These men frequently become alarmed and report to their medical officer in the belief that they have a venereal disease. In such cases, reassurance is all that is necessary in the way of therapy.

*Alcoholic urethritis.* A burning sensation in the urethra during urination and a slight urethral discharge is seen in some persons after alcoholic excesses. The discharge is free of organisms and clears spontaneously in from 24 to 48 hours provided no more alcohol is consumed and the patient gets sufficient rest.

*Normal prostatic secretion.* In some who have not had sexual relief for a long time a "spilling over" of normal prostatic secretion occurs, usually while straining at stool, or as a urethral discharge seen on arising in the morning. Laboratory examinations of the discharge reveal normal prostatic secretion. The only therapy needed is reassurance.

An unclean preputial sac may give rise to infection of the anterior urethra. Such infections are treated effectively with soaks plus penicillin given systemically. Circumcision should be recommended where necessary and the patient instructed in personal hygiene.

Very rarely, *foreign bodies in the urethra* are found as the cause of a discharge.

Urethral irritations are found to result in some patients from *vaginal secretions* or *sensitizing vaginal jellies* or *douches*. Frequently in such patients, the skin of the penis reveals evidence of the sensitization.

*Partial urethral obstructions* or anatomic defects behind which bacteria may lodge and act as foci of infection are found in some patients with recurrent urethral discharges occurring over long periods of time.

#### CHARACTERISTICS OF NONGONOCOCCAL URETHRITIS

At Camp Lejeune, excluding all of the foregoing categories, there were still about 150 cases per month of the entity described below or roughly 3 times the incidence of gonorrhea. All such patients were studied for at least 3 days before any form of therapy was instituted. On each of the days of study, a gram-stained smear of the discharge was made. A culture was grown on chocolate media under carbon dioxide tension. With many patients an additional blood agar culture was taken and grown aerobically. Several hundred of these patients were interviewed by myself and other trained interviewers used in venereal disease contact reporting. By means of these interviews the following characteristics of the disease were determined:

1. The first symptom of the disease is usually a burning sensation in the urethra during urination. This is followed shortly by a urethral discharge.
2. The discharge is usually mucopurulent or purulent and is seldom as profuse as the usual discharge seen in gonorrhea.
3. The incubation period is usually at least 14 days after intercourse and frequently longer; rarely is it found to be shorter.
4. The course may be prolonged. Some patients reported that they had had this disease for from 6 months to several years.
5. A history of sexual exposure was elicited in virtually 100 percent of the patients. Almost all had failed to use mechanical prophylaxis or prophylactic salve. From foreign areas, reports of this disease in those who had taken penicillin prophylactically by mouth reveal that that form of prophylaxis is ineffective in preventing nongonococcal urethritis, although it is from 90 to 100 percent effective in preventing gonorrhea when used shortly after exposure.
6. This disease may exist concurrently with gonorrhea and be diagnosed when the urethral discharge continues after adequate treatment

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# Chronic Segmental Atelectasis<sup>(1)</sup>

William R. Beisel, Captain, MC, U. S. A.

James O. Gillespie, Brigadier General, MC, U. S. A.

**C**HRONIC pulmonary atelectasis localized to individual segment forms a distinct clinical entity which is now being recognized with increasing frequency. The importance of tuberculous hilar lymphadenopathy and endobronchial tuberculosis in causing this condition is worthy of emphasis. In 1920 Eliasberg and Neuland (2) introduced the term "epituberculosis" to describe the sudden appearance of a large, fairly uniform roentgenographic density in the lung fields of children who were undergoing a primary tuberculous infection. These patients were characterized by apparent excellent health despite the ominous appearance of the roentgenographic lesion, and eventual clearing was usually spontaneous and complete. Recent writers (3-9) have discarded the term "epituberculosis," believing that its features are those of a lobar or segmental atelectasis caused by pressure from enlarged hilar nodes. The major experimental work on the pathologic

(1) From the Letterman Army Hospital, San Francisco, Calif.

(2) Eliasberg, H., and Neuland, W.: Die epituberkulose Infiltration der Lunge bei tuberkulosen Sauglingen und Kindern. Jahrb. f. Kinderh. 93: 88, 1920.

(3) Head, J. R., and Moen, C. W.: Late nontuberculous complications of calcified hilus lymph nodes. Am. Rev. Tuberc. 60: 1-14, July 1949.

(4) Hutchison, J. H.: Bronchoscopic studies in primary tuberculosis in childhood. Quart. J. Med. 18: 21-49, Jan. 1949.

(5) Jones, E. M.; Rafferty, T. N.; and Willis, H. S.: Primary tuberculosis complicated by bronchial tuberculosis with atelectasis (epituberculosis). Am. Rev. Tuberc. 46: 392-406, Oct. 1942; Abstr., Tr. Am. Clin. & Climatol. A. (1941) 57: 102-106, 1942.

(6) Jones, E. M.; Peek, W. M.; and Willis, H. S.: Bronchiectasis following primary tuberculosis. Am. J. Dis. Child. 72: 296-309, Sept. 1946.

(7) Jones, O. R., and Cournand, A.: Shrunken pulmonary lobe with chronic bronchiectasis. Am. Rev. Tuberc. 28: 239-316, Sept. 1933.

(8) Kent, E. M.: Bronchial obstruction and pulmonary atelectasis as seen in childhood tuberculosis with secondary bronchiectasis as sequela. Am. Rev. Tuberc. 46: 524-531, Nov. 1942.

(9) Laff, H. L.; Hust, A.; and Robinson, A.: Importance of bronchial involvement in primary tuberculosis of childhood. J. A. M. A. 146: 778-783, June 30, 1951.

physiology of atelectasis was published by Coryllos and Birnbaum (10, 11) in 1929. With the rapid development of thoracic surgery and the increasing knowledge concerning the detailed anatomy of the tracheobronchial tree, special roentgenographic views and technics have been developed (12-21) for the diagnosis and localization of atelectasis in individual pulmonary segments.

Relatively few physicians, when confronted with the problem of the cause of chronic segmental atelectasis are aware of the high incidence of positive findings of tubercle bacilli by culture and guinea pig in these patients.

This article deals with a study at this hospital in the past 3 years of 12 adult patients showing chronic segmental atelectasis. This diagnosis is limited to patients showing a prolonged atelectasis of 1 or more of the named bronchial segments; in each instance possible etiologic factors such as neoplasm, foreign body, postoperative atelectasis, or widespread pulmonary tuberculosis have been ruled out. In 5 of these patients, tubercle bacilli were isolated by culture or guinea pig inoculation and in the remainder certain evidence incriminated calcified hilar lymph nodes as the probable cause of bronchial obstruction.

(10) Coryllos, P. N., and Birnbaum, G. L.: Circumstances in compressed, stenotic and pneumonic lung (pneumothorax-pneumonitis-pneumonia). *Arch. Surg.* 19: 1346-1424, Dec. (pt. 2) 1929.

(11) Coryllos, P. N., and Birnbaum, G. L.: Alveolar gas exchanges and atelectasis, mechanism of gas absorption in bronchial obstruction. *Arch. Surg.* 21: 1214-1281, Dec. (pt. 2) 1930.

(12) Bajum, V. L.: X-ray diagnosis of cuneiform atelectasis and its significance in childhood tuberculosis. *Ext., Am. Rev. Tuberc.* 55: 14, 1947.

(13) Doig, A. T.: Atelectatic bronchiectasis of right middle lobe. *Tubercle* 27: 173-190, Nov. 1945.

(14) Graham, E. A.; Burford, T. H.; and Mayer, J. H.: Middle lobe syndrome. *Postgrad. Med.* 4: 29-34, July 1943.

(15) Robbins, L. L.; Hale, C. H.; and Merrill, O. E.: Roentgen appearance of lobar and segmental collapse of lung; technic of examination. *Radiology* 44: 471-476, May 1945.

(16) Robbins, L. L., and Hale, C. H.: Roentgen appearance of lobar and segmental collapse of lung; normal chest as it pertains to collapse. *Radiology* 44: 543-547, June 1945.

(17) Robbins, L. L., and Hale, C. H.: Roentgen appearance of lobar and segmental collapse of lung; collapse of entire lung or major part thereof. *Radiology* 45: 23-26, July 1945.

(18) Robbins, L. L., and Hale, C. H.: Roentgen appearance of lobar and segmental collapse of lung; collapse of lower lobes. *Radiology* 45: 120-127, Aug. 1945.

(19) Robbins, L. L., and Hale, C. H.: Roentgen appearance of lobar and segmental collapse of lung; collapse of right middle lobe. *Radiology* 45: 250-266, Sept. 1945.

(20) Robbins, L. L., and Hale, C. H.: Roentgen appearance of lobar and segmental collapse of lung; collapse of upper lobes. *Radiology* 45: 347-355, Oct. 1945.

(21) Stvelman, B. P.: Atelectasis in pulmonary tuberculosis. *J. A. M. A.* 99: 1566-1570, Nov. 12, 1932.

## ETIOLOGY

A tuberculous process in hilar lymph nodes is the major single cause of chronic segmental atelectasis. Bronchial obstruction may be caused by extrinsic pressure from enlarged tuberculous nodes or by penetration of the caseous process through the bronchial wall. Atelectasis may occur during a primary tuberculous infection or after the tuberculous hilar node has become calcified and apparently quiescent (3). Doig (13) reported 14 patients with atelectasis from the middle lobe of the right lung which apparently followed an attack of pneumonia, measles, or pertussis, although none of the patients had a preceding pulmonary tuberculosis or were contacts of persons with open tuberculosis. In a review of 30 cases with atelectasis (diagnosed roentgenographically) Brum (12) found that 154 were caused by tuberculosis, 69 by influenza, 47 by pneumonia, and 30 by measles.

Tuberculosis was excluded as an etiologic factor in each of the 12 patients with atelectasis of the middle lobe of the right lung reported by Graham et al. (14). In these patients, microscopic examination of the nodes producing atelectasis by bronchial compression revealed only chronic nonspecific lymphadenitis.

## PATHOGENESIS

It has been conclusively proved that complete obstruction of a bronchus is the only cause of atelectasis (22). Such factors as (1) respiratory muscle paralysis, (2) bronchomotor and vasomotor nervous reflexes, (3) interference with thoracic movements by pain or narcotics, (4) extrapulmonary infection, and (5) general exhaustion may each contribute to the development of pulmonary atelectasis, but obstruction of a bronchus must be complete before atelectasis actually occurs.

The incidence of segmental or lobar atelectasis during the course of childhood tuberculosis has been well documented (4-9, 12, 23). Inflamed tuberculous hilar nodes may compress or kink a bronchus by simple, extrinsic, mechanical pressure, leading to narrowing of the bronchial lumen and plugging with trapped secretions. This mechanism is most common in children where the bronchi are softer and more easily compressed than in adults. Slight changes in the degree of extrinsic pressure or in the amount of retained secretions may cause the bronchial obstruction to be intermittent. For this reason atelectasis

(22) Cotylos, P. N.: Importance of atelectasis in pulmonary tuberculosis; its relation to fibrosis and to pathogenesis and healing of tuberculous cavities. Am. Rev. Tuberc. 28: 126, July 1933.

(23) Stoloff, E. G.: Acute massive atelectasis of lung, complicating fresh tuberculous primary complex. Am. J. Dis. Child. 35: 239-249, Feb. 1928.

caused solely by extrinsic pressure on a bronchus frequently shows fluctuating clinical findings. If sufficient outpouring of secretions and exudates fills the distal bronchioles and alveoli, the size of the involved pulmonary segment remains unchanged despite the presence of atelectasis and there results a "drowned" segment rather than a shrunken one.

A tuberculous process in hilar nodes may also lead to atelectasis by direct extension to an adjacent bronchus. The intensity of a tuberculous reaction is greater than that due to nongranulomatous pulmonary infections and there is frequent involvement of adjacent connective tissue, lung parenchyma, vessels, pleura, or bronchi. Penetrating caseation necrosis involving a bronchial wall leads to the development of concomitant endobronchial tuberculosis through the formation of fistulous tracts from the interior of the node. Masses of caseous or calcified debris may then be extruded into the bronchial lumen. Endobronchial ulcer formation or elevated granulomatous tissue may in themselves completely obstruct a bronchus or may sufficiently destroy the continuity of the ciliary and peristaltic motions of the bronchi so as to permit accumulation of secretions, bronchial obstruction, and atelectasis.

Brock (24) emphasized that a residual tight fibrous stricture frequently remains as a cause of bronchostenosis even after the active tuberculous involvement of a bronchus has apparently resolved. Once segmental atelectasis has occurred, future pathogenesis is determined by the duration of atelectasis and the presence or absence of infection. Usually the bronchi become filled with purulent exudate, with secondary destruction of the ciliated epithelium, submucosa, and, occasionally, of the entire bronchial wall. Focal pneumonia may progress to widespread interstitial pulmonary fibrosis. Abscess formation and empyema are less common complications. Hennell (25) pointed out that the initiating tuberculous process in a bronchus may be completely submerged by the extensive secondary infection distal to the point of obstruction. Terminally there may remain an atelectatic, shrunken, bronchiectatic, and fibrotic pulmonary segment.

Fibrosis and bronchiectasis need not occur in every case, however, for it has been demonstrated that an atelectatic lobe may remain free of bronchiectasis for years if no infection occurs. All the clinical findings can then resolve completely if the bronchial obstruction is relieved (5).

The special predilection of the right middle lobe to the development of atelectasis has been emphasized by recent writers (13, 14, 24, 26-30).

(24) Brock, R. C.: Post-tuberculous bronchostenosis and bronchiectasis of middle lobe. *Thorax* 5: 5, 1950.

(25) Hennell, H.: Atelectasis as factor in evolution of chronic fibroid pulmonary tuberculosis. *Am. Rev. Tuber.* 23: 461-475, May 1931.

(26) Bryant, J. R., and Harter, J. S.: Middle lobe disease. *Dis. Chest* 18: 250-253, Sept. 1950.

Brock (24, 27) explained this simply on the basis of the anatomy of the right hilar region. The right middle lobe bronchus is completely surrounded by lymph nodes which receive drainage from the middle and lower lobes of the right lung. In addition, the right middle lobe bronchus leaves the main stem bronchus at a very acute angle in which is consistently found a rather large lymph node. This exposes the right middle lobe bronchus to a greater risk of kinking or occlusion when compared to other major bronchi.

#### CLINICAL FEATURES

Chronic segmental atelectasis can occur at any age. The greatest number of reported cases have occurred in children. Sex distribution is of no apparent significance, although a recent series (30) of 8 female patients with an average age of over 60 years has been reported. In children, segmental atelectasis is frequently observed during the initial primary tuberculous infection. In adults, an acute bronchial or pulmonary infection can initiate this process, although the presence of previously diseased hilar lymph nodes makes the development of bronchial obstruction more likely. The exact cause in an individual patient may be difficult, if not impossible, to determine despite extensive diagnostic studies. Although fever, productive cough, chest pain, and abnormal physical findings are usually present at the onset of atelectasis, during the chronic phase of prolonged atelectasis the patient is rarely clinically ill. Recurrent pulmonary infection and a chronic cough with a variable degree of sputum production are common. Hemoptysis may occur. In short, a patient harboring an atelectatic segment frequently presents symptoms similar to those of minimal bronchiectasis.

Blood counts usually fall within normal limits after the atelectasis enters a chronic phase. Elevated sedimentation rates are present in most patients. The tuberculin skin test is almost always positive and careful study of the sputum and gastric washings with culture and guinea pig inoculation frequently gives conclusive proof of tuberculosis. The diagnosis of segmental atelectasis must be established by roentgenographic means, with special views and techniques being employed as indicated. The exact site and cause of bronchial obstruction can often be visualized directly at bronchoscopy.

The duration of atelectasis is variable, lasting only a few weeks in some patients and remaining permanently in others. Kent (8) believes that if the atelectatic area re-expands within a period of 6 months the patient will usually escape bronchiectasis.

(27) Brock, R. C.: Anatomy of the Bronchial Tree. Oxford University Press, New York, N. Y., 1946. p. 52.

(28) Rubin, E. H., and Rubin, M.: Shrunken right middle lobe, with reference to so-called "middle lobe syndrome." Dis. Chest 18: 127-143, Aug. 1950.

(29) Zdansky, E.: Der Mittellappen als Punctum minutis resistens der Lunge. Wien. klin. Wochschr. 58: 197-200, Apr. 1946.

(30) Cohen, A. G.: Atelectasis of right middle lobe resulting from perforation of tuberculous lymph nodes into bronchi in adults. Ann. Int. Med. 33: 820. 1951.

### ROENTGENOGRAPHIC FINDINGS

Although the diagnosis of atelectasis localized to individual pulmonary segments must be established roentgenographically, this is often difficult to accomplish because of several factors. The comparative roentgenographic density of normal and atelectatic pulmonary tissue is only slightly different; hence, an atelectatic area may be only faintly outlined and usually blends into normal tissue without definite demarcation. The cardinal signs of acute massive atelectasis (shift of the mediastinum, elevation of the diaphragm, narrowing of the rib spaces, and compensatory emphysema of the aerated lobes) are absent in segmental atelectasis. A collapsed segment or lobe shrinks medially toward the hilum and will not be seen in its usual location. Changes in contour or location of the interlobar septums, rearrangement of vascular shadows, and change in position of the hilum are important details to be noted in diagnosing lobar or segmental atelectasis.

A frontal view of the chest is often not striking and may appear almost normal. A lateral view is absolutely necessary for adequate study and visualization of the septal shadows. The importance of the lordotic view in a study of the middle lobe of the right lung and lingular segments of the upper lobe of the left lung is well documented. Additional special views may be indicated in some patients. Bronchograms may show failure of filling of the involved bronchial segment with compensatory displacement of surrounding bronchi, and occasionally bronchiectatic changes within the shrunken area may be demonstrated.

In a series of detailed papers, Robbins and Hale (15-20) have reviewed the diagnostic features of atelectasis in each of the various named bronchial segments.

### BRONCHOSCOPIC FINDINGS

Bronchoscopy is of special importance in the study of chronic segmental atelectasis for in many patients the area of bronchial obstruction can be directly visualized. In addition, biopsy specimens and material for cellular study can be obtained which will aid in excluding the possibility of neoplasm. Bronchoscopic study of groups of children undergoing an initial tuberculous pulmonary infection reveals abnormal findings in a large percent (4, 5, 9). These include (1) narrowing of the bronchial lumen due to extrinsic pressure presumably from an enlarged hilar lymph node, (2) ulcerated areas covered by granulation tissue, (3) endobronchial granulomatous masses, and (4) impending perforation of a bronchus by a tuberculous process in an adjacent node. In some patients, particles of caseous material can be removed from the bronchi.

Bronchoscopic findings in adults are essentially similar and include the occasional recovery of broncholiths or the direct visualization

of the granulomatous bed of a recently extruded broncholith (31). Cohen (30) regards the presence of anthracotic pigment in the vicinity of an old endobronchial scar as presumptive evidence of previous lymph node perforation. In patients in whom a frankly tuberculous lesion cannot be proved, narrowing of a bronchus with a slitlike orifice caused by mucosal edema and a nonulcerating inflammatory reaction are frequently found. Pus must sometimes be aspirated from a bronchus before such a condition can be visualized. Any of these bronchial lesions may terminate with a residual tight cicatricial stenosis. In some patients bronchoscopic study may fail to show the region of bronchial obstruction.

### CASE REPORTS

**Case 1.** A 71-year-old retired mining engineer was hospitalized because of an arteriosclerotic aneurysm of the abdominal aorta. He had been previously studied in other hospitals because of atelectasis of the middle lobe of the right lung which remained roentgenographically unchanged over a period of several years. Bronchoscopy and repeated sputum cultures had produced only negative findings.

Physical examination revealed a senile, cachectic, critically ill man complaining of severe abdominal pain. A large pulsating mass was present in the lower abdomen; no abnormal findings were detected on examination of the chest. During the final hospitalization a localized infiltration developed in the left lower lung field along with a productive cough. Detailed additional study of the chest lesions was not possible because of the patient's critical condition. The abdominal aneurysm progressively increased in size with extensive terminal retroperitoneal hemorrhage from which the patient died.

Necropsy study showed complete atelectasis of the middle lobe of the right lung with extensive fibrosis and bronchiectasis. The bronchus was occluded by a group of enlarged firm encircling lymph nodes which yielded tubercle bacilli on culture and which showed fibrocaseous changes with surrounding areas of caseation necrosis on microscopic study. A small area of tuberculous caseation necrosis was also found in the lower lobe of the left lung.

**Comment.** Atelectasis in this patient was due to bronchial compression by enlarged tuberculous hilar nodes. The atelectasis was of undetermined duration and caused only mild symptoms and no disability during the period of observation. Although the tuberculous process in the hilar nodes was apparently quiescent, the patient's terminal debilitated condition caused it to become activated with tuberculous spread to an area in the left lung.

(31) Fox, J. R., and Clerf, L. H.: Broncholithiasis; report of 10 cases. Ann. Int. Med. 23: 935-939, Dec. 1945.

(about 2 minutes). The cylinder valve was then closed and both of the chamber valves were closed to prevent escape of the gas. This procedure was carried out at 0800 and at 1700 for 2 days. Between gassings the door of the box remained closed. At the end of 48 hours the samples were removed aseptically and plated on Sabouraud's agar. The plates were then incubated for 10 days at room temperature. Micro-organisms were not recovered from any of the sterilized samples.

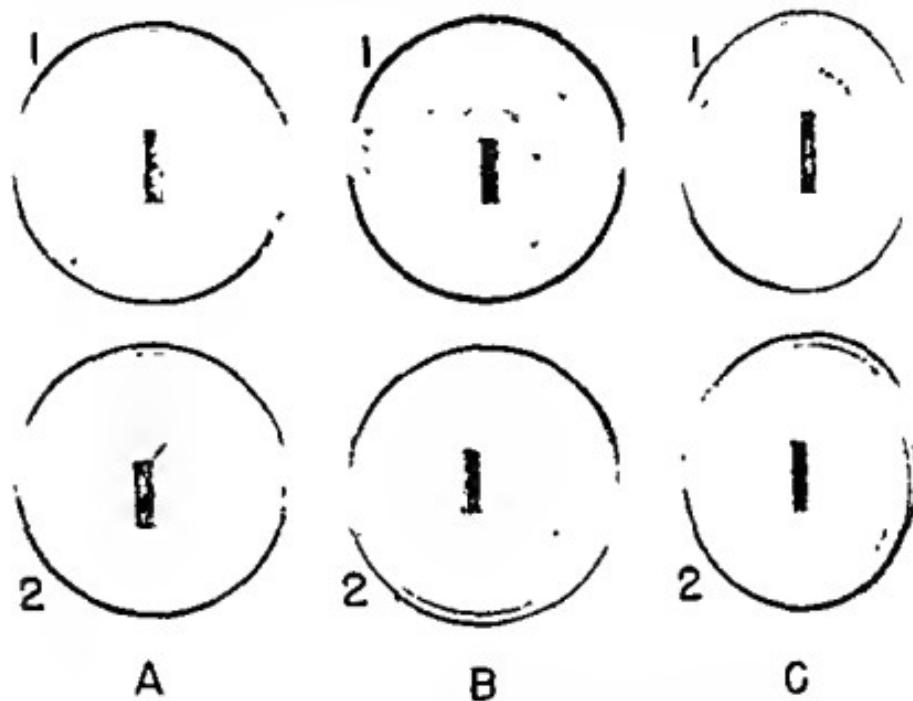


Figure 3. Sterilized leather samples contaminated with pathogenic fungi. (A) *M. gypseum*. (B) *M. canis*. (C) *T. mentagrophytes*. Specimens numbered 1 were nonsterilized; those numbered 2 were sterilized.

The next series of experiments was designed to determine the possibility of sterilizing leather samples contaminated with certain pathogenic fungi. For the initial tests *Microsporum canis*, *Microsporum gypseum*, and *Trichophyton mentagrophytes* were used as test organisms. These fungi were planted on Sabouraud's agar in Petri plates and incubated at 37° C. for 16 days. Leather samples previously sterilized with carbon dioxide gas were then pressed into the growing fungus colony. The samples remained on the colony for 12 days at 37° C., at which time the leather samples were completely overtaken with the fungus. At the end of this period, some of the contaminated samples, selected at random, were planted on Sabouraud's agar plates and incubated at 37° C. for 10 days. The remaining contaminated samples were placed in dry, sterile Petri plates and exposed to carbon dioxide gas for 48 hours. At the termination of exposure the samples were arrested, planted on Sabouraud's agar and incubated at 37° C. for 15 days.

No fungus growth was obtained from any of the treated samples contaminated with the test organisms but luxuriant growth was obtained from each of the nontreated contaminated samples (fig. 3).

To determine the possibility of sterilizing other pathogenic fungi by exposure to carboxide gas in the delousing bag chamber, cultures of *Monosporium apiospermum*, *Pbialophora verrucosa*, *Epidermophyton floccosum*, *Sporotrichum schenckii*, *Trichophyton rubrum*, and *Trichophyton schoenleinii* were plated on Sabouraud's agar in Petri plates. These cultures were incubated at 37° C. for 16 days. Leather samples cut from shoe soles and previously sterilized by exposure to carboxide gas were pressed into the growing fungus colonies and allowed to remain for 12 days at 37° C. At the end of this period the contaminated samples were removed and placed in dry sterile Petri plates. Some of the plates containing the contaminated samples were placed in the delousing bag chamber and the bag was filled to tautness with carboxide gas. Eight hours later the chamber was regassed to the original degree of tautness. Twenty-four hours after the original application of gas the plates containing the samples were removed and aerated for 6 hours. The samples were then plated on Sabouraud's agar and incubated for 15 days at 37° C. The remaining contaminated samples were plated directly, without further treatment, on Sabouraud's agar and incubated with the treated samples. At the termination of the incubation period all of the samples treated with carboxide gas showed no growth of fungi, and the controls all showed fungus growth.

#### STERILIZATION OF SHOES

*G. I. can.* Well-worn shoes, wrapped in paper to prevent contamination during latent handling, were placed in the can. The carboxide gas was turned into the can through the bottom inlet valve and allowed to flow for about 2 minutes. The chamber was regassed at 1, 3, 5, 6, 21, and 23 hours after the initial gassing. At the termination of the experiment (24 hours) the shoes were removed from the can, aerated in their paper wrappings for 3 hours, and sampled by the punch technic. The layers obtained were separated and plated on Sabouraud's agar and incubated for 7 days at 37° C. The mates to the treated shoes were sampled directly and plated. At the end of 7 days' incubation each of the control or untreated shoes showed fungus growth from all layers. Two of the treated shoes gave no growth from any of the layers, but the other treated shoes showed growth from all of the layers. This difference might be explained by the position of the shoes in the container. The shoes that were closer to the bottom of the container may have been exposed to higher concentrations of ethylene oxide; however, no records concerning this were available. As the results obtained with this container were not sufficiently good to justify further work, it was decided to test another of the exposure containers.

*Hypochlorite bleach drum.* Four well-worn shoes were wrapped in paper and placed in the container. The drumhead was tightened and

bag with thicker and tighter walls. To this end, the B-29 inner tube chamber previously described was designed.

*B-29 inner tube.* Increasing the ethylene oxide concentration will decrease the time required for killing certain micro-organisms (10). The ethylene oxide content of the carboxide gas used was determined by the method of Phillips and Kaye (8) and found to be 184 mg. per liter.

For the initial test of the B-29 inner tube chamber, the toes were removed from 6 well-worn shoes and both portions of the shoes were placed in the chamber which was then filled with carboxide to a pressure of 20 cm. of water. One hour after the chamber was filled, the gas content was analyzed and found to contain 34 mg. of ethylene oxide per liter of gas, a loss of over 81 percent of the original content. Three hours later the ethylene oxide concentration had dropped to 31 mg. per liter. Immediately prior to the removal of the shoes, the content of ethylene oxide was found to be 26 mg. per liter. This was an 86 percent loss in 24 hours.

The shoe toes were placed in sterile cellophane bags and aerated for 6 hours. The insides of the toes were then coated with 20 cc. of melted Sabouraud's agar, placed in moist sterile culture dishes, and incubated in a humidified incubator at 37° C. for 6 days. The toes of the mates to the shoes exposed to the gas were treated identically with the treated shoes, except for the exposure to the gas. At the end of a 6-day incubation period the toes of all the control shoes showed luxuriant fungus growth. The treated shoe toes all gave evidence of growth but not such luxuriant growth as that obtained from the control shoes.

Apparently the concentration of ethylene oxide in the gas was not sufficiently high to sterilize the shoes. In the next experiment the ethylene oxide content was increased in the following manner: 90 cc. of liquid ethylene oxide was measured into a vacuum flask which was then stopped and the side arm connected to the valve of the chamber. The vacuum flask was then immersed in warm water and the liquid ethylene oxide vaporized into the chamber. Sufficient carboxide gas was then added to raise the pressure to 20 cm. of water.

Analysis of the gas obtained with this mixture showed it to contain 940 mg. of ethylene oxide per liter of gas. To determine the degree of loss of ethylene oxide through the walls of the chamber, this mixture was allowed to remain in the bag for 24 hours. At that time, analysis of the gas showed it to contain 851 mg. of ethylene oxide per liter, a loss of 10 percent, due probably to a diffusion through the walls of the chamber.

The next experiment consisted of removing the toes from 6 shoes and placing both portions of the shoes in the chamber. Ninety cubic

(10) Kaye, S., and Phillips, C. R. Sterilizing action of gaseous ethylene oxide, effect of moisture. Am J Hyg. 50: 296-306, Nov. 1949.

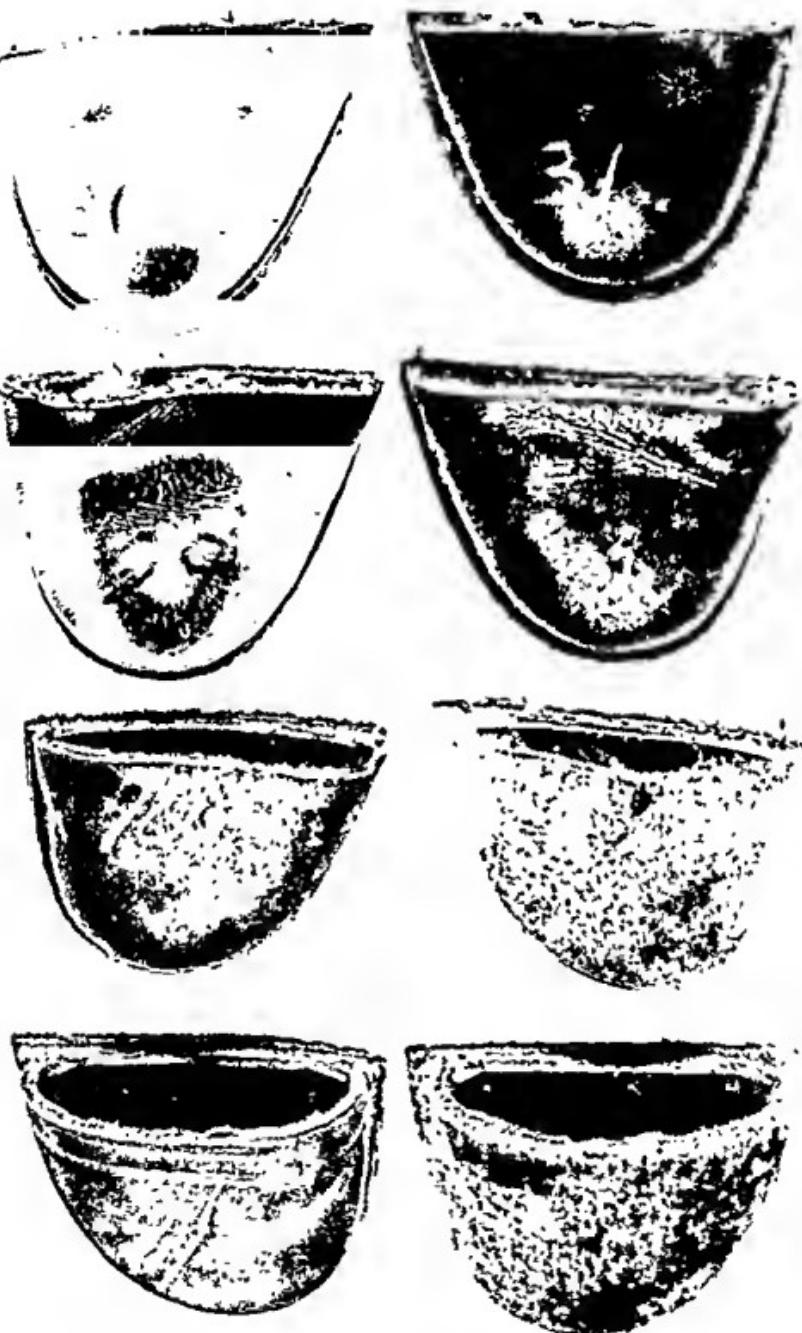


Figure 4. Shoes treated with carboxide gas. Right: Untreated shoes. Left: Treated shoes.

proportion of minimal lesions. Although detailed average strength data were not more available for these than for stewards and aviation enlisted men, a count according to age and rating as of 19 August 1949 was available. Using these data the rates shown in table 6 were computed. There was a very low incidence of new patients among the older medical and dental enlisted personnel. A possible association of the patients with youth and with the ratings most intimately involved in the care of the sick seems to be suggested. The factor of association with care of the sick is not weakened by the fact that contact with tuberculous patients or their discharges within 5 years of admission was known to have occurred in 35 percent of the patients in this group. Contact with tuberculous friends or relatives outside the service was known in 13 percent of the patients, practically the same as that recorded in table 5 for other enlisted personnel among whom known contact in the service was rare. The degree of involvement on admission was minimal in 9 of the 20 patients with pulmonary tuberculosis. The result of a tuberculin test at time of entering the service, and of repeated tests thereafter, would assist greatly in evaluating the association of these patients with care of the sick. Because the Hospital Corps is made up of volunteers, and because the prior experience of applicants is considered when assigning them, the factor of selection as a force producing the higher rates should be considered in future studies.

Past attempts to relate the onset of disease to station of duty have been fruitless because so often the evidence of illness which had its onset elsewhere is not noted until return to the United States where roentgenographic facilities are more generally available. Admissions for illness acquired overseas or in ships may take place after arrival at continental receiving stations and, therefore, be included in the statistics for the continental United States. So, in arriving at the distribution shown in table 7, the station of duty at onset was arbitrarily defined as the last area or ship assignment of more than 2 months' duration. Because the time spent in the area or ship varied from several months to several years, no confidence may be placed in small differences in rates. The exception to a fairly uniform distribution is ships, where the rate for pulmonary disease among patients with no known prior evidence of disease was higher than would have been predicted from experience ashore in the United States or overseas. Should this exception be noted consistently, it would justify the traditional fear of tuberculosis as a marine disease and emphasize the hazard healthy persons face when living and working in close company with a chronic carrier of the tubercle bacillus. The ratio of Caucasian to non-Caucasian patients was about 10:1 for ships and ashore in the United States and 4:1 for shore, overseas.

On the basis of table 8 tuberculosis should have been discovered in 7 percent of the patients prior to the time that it was, the delay being due to technically unsatisfactory films, failures in interpreting films, and recommendations made improperly or not carried out. The problems

TABLE 7. Method of discovery and place at onset\*, related to prior evidence of lesion, number of patients and rate per 100,000 average strength for pulmonary tuberculosis, active or recently active, United States Navy, 1949

Prior evidence of lesion in review of records**	Method of discovery	Place at onset				Number of patients	Rate per 100,000	Number of patients	Rate per 100,000	Number of patients	Rate per 100,000						
		Ashore		Ships													
		United States	Overseas														
Absent	Total	97	31	12	22	78	44				3						
	Routine roentgenogram***	49	16	6	11	41	23				1						
	Symptoms	48	15	6	11	37	21				2						
Present	Total	42	14	9	17	32	18										
	Routine roentgenogram***	25	8	4	8	18	10										
	Symptoms	17	6	5	9	14	8										
Not known	Total										2						

\*Last ship or station assignment of more than 2 months' duration prior to admission.

\*\*All records and available miniature films were reviewed for evidence that questionable lesions indicated admission.

\*\*\*Routine roentgenograms made in accordance with directives or as part of the clinical investigation of a nonrespiratory illness.

amenable to indicated surgical treatment. Transthoracic esophagotomy for the removal of an impacted and traumatizing foreign body is now sometimes safer than so-called conservative attempts at removal through esophagoscope with almost certain trauma or perforation and resultant mediastinitis. This is especially true when the services of a surgeon who is skilled in removal of foreign bodies through the esophagoscope are not available. The following case is reported as an example.

#### CASE REPORT

A 17-year-old soldier was admitted to this hospital on 13 February 1950, having been transferred by airplane. At about midnight on 11 February he had suddenly awakened and noted bleeding from his throat. His removable denture, consisting of the upper 2 central incisors, from which a clasp and porcelain facing had been broken months before, which fitted none too snugly, and which he habitually wore while sleeping, had disappeared and seemed to be lodged deep in his throat. He immediately sought medical advice. Radiologic examination revealed the partial denture to be in the upper esophagus. At the local medical installation, no attempt at removal or instrumentation was made. He was not given any food or liquids by mouth. Penicillin was administered intramuscularly. Frequent radiologic examinations revealed that the foreign body had progressed downward to a point where it became immobile at the level of the seventh and eighth thoracic vertebrae (fig. 1). The patient was in no distress.

The denture was about 5 cm. long and 1.5 cm. wide. There were 7 sharp, curved clasps which pointed in all directions so that they could easily imbed themselves in the esophageal wall, no matter in which direction the denture was moved (fig. 2). Through the esophagoscope, the denture was easily seen at the level noted on the roentgenograms. It could not be moved by gentle manipulation. Another esophagoscopic examination and unsuccessful attempt to remove or dislodge the foreign body was performed on 15 February, 35 hours after admission. The position of the denture had not changed. During this time, the patient's temperature and leukocyte count remained normal. He had expressed no complaints except for the discomfort of the esophagoscopic procedures.

A Levine tube was inserted through the nose, into the esophagus, and on into the stomach. It passed the lodged foreign body with ease. It was determined that the denture with its 7 curved and sharp clasps was firmly imbedded in the esophageal wall and that further endoscopic manipulative attempts would be unsuccessful and result in added trauma with possible perforation of the esophagus. Furthermore, to delay in removing the traumatizing foreign body would also result in eventual perforation and mediastinitis. It was decided to remove the foreign body by esophagotomy through the pleura.

At 1900 hours on 15 February, 45 hours after admission and 91 hours after swallowing the denture, the foreign body was removed by per-



Figure 1. Chest projection of the chest revealing the position of the foreign body in the esophagus.  
Figure 2. Foreign body removed from the esophagus.





FIGURE 1 (CASE 2). Radiogram showing air admittance into the upper mediastinum (case 2). Lateral roentgenogram of the chest made on admission demonstrating the pneumothorax situated beneath the partial plane of the diaphragm.

and holds his breath, despite his understanding of the mechanism of safe approach to lower pressure levels. The excitement of the chase may contribute to this tendency to hold the breath. The relative intrapulmonary pressure rises and a weak bleb wall ruptures.

The second case was precipitated by exercise and strain while in an inverted position with head and shoulders submerged. Although this was also a Valsalva effect, no great ambient pressure change was experienced. Overenthusiasm was responsible in great degree.

The more common injuries incident to skin diving include sunburn of various degrees, minor lacerations and punctured wounds, coral abrasions, various stings and locally toxic injuries produced by coelenterates and plants encountered on the reefs, none of which deter the participants nor, indeed, is this newly recognized hazard likely to do so.

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# Pronestyl in the Treatment of Ventricular Tachycardia<sup>(1)</sup>

Charles L. Leedham, *Colonel, MC, U. S. A.*

William H. Isham, *Captain, MC, U. S. A.*

**P**ROCAINE amide hydrochloride (pronestyl) has recently been advocated for use in the treatment of ventricular tachycardia (2). The drug can be administered orally or intravenously. A report of a case of paroxysmal ventricular tachycardia treated with both oral and intravenous pronestyl follows.

## CASE REPORT

A 24-year-old man was admitted to this hospital on 24 May 1951 complaining of tachycardia occurring over a period of 18 months prior to admission. There was no history of cardiac disease or rheumatic fever. These attacks of tachycardia were accompanied by dyspnea, pounding noises in the ears, vertigo, and a sensation of impending syncope. The symptoms would last for a few minutes and then disappear but the tachycardia would persist for periods varying from 1 hour to 1 week. Usually the attacks would last from 1 to 2 hours. Pressure on the eyes, ice packs to the chest, mild sedatives, and digitalis were all tried without lasting results. On the day prior to admission, the patient had an attack of tachycardia which lasted about 24 hours. He stated that he smoked 1 or 2 packages of cigarettes a day and that his alcoholic intake was small.

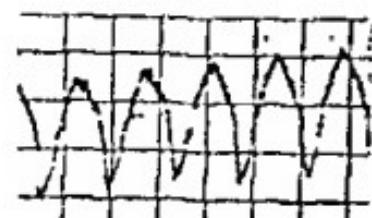
His blood pressure was 124/88. His heart was not enlarged to percussion and no murmurs or thrills were noted. On admission the rhythm was normal and the rate was 85. An ECG on the day of admission revealed ventricular extrasystoles, a sinus tachycardia, and inverted T-waves in leads 2, 3, AVF, V<sub>5</sub>, and V<sub>6</sub>. On the following day an ECG showed ventricular tachycardia. ECG's immediately following the cessation of the tachycardia revealed inversion of the T-waves in all limb

(1) Tripler Army Hospital, Honolulu, T. H.

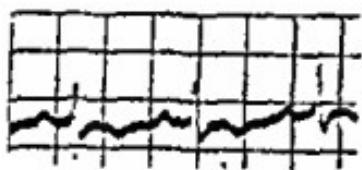
(2) Mark, L. C.; Berlin, L; Paden, H. J.; Rovenstein, E. A.; Steele, J. M.; and Brodie, B. B.: Action of procaine amide ( $N$ -{(2-diethylamino-ethyl)-P-amino-benzamide}) in ventricular arrhythmias. *J. Pharmacol. & Exper. Therap.* 98: Jan. 21, 1950.

leads and in the precordial leads  $V_4$ ,  $V_5$ , and  $V_6$  (fig. 1). The patient had 2 subsequent attacks of ventricular tachycardia in the hospital. By 12 July the T-waves in the limb leads were assuming a more normal pattern. The T-waves in leads  $V_4$  and  $V_5$  were still slightly inverted (fig. 2).

**25 May**



**A**



**B**

1 min.

**24 May**



**Lead**

**1**



**2**



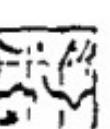
**3**



**AVR**



**AVL**

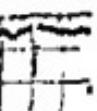


**AVF**

**25 May**



**12 July**



11 mm.

**Figure 1** (A) Lead I taken during ventricular tachycardia. (B) Lead I taken 1 minute after intravenous injection of 100 mg. of pronestyl. Figure 2 ECG's illustrating T-wave changes that occurred during hospitalization. 24 May tracings were taken at the time of admission. 25 May tracings were taken immediately following an attack of ventricular tachycardia and an intravenous injection of pronestyl. 12 July tracings were taken after 6 weeks' bed rest and gradual ambulation with the patient on a maintenance dose of pronestyl.

On the day following admission immediately after completing an electrocardiographic tracing with a normal sinus rhythm, the patient began to smoke a cigarette. Within 1 minute of lighting the cigarette, he noted the symptoms associated with previous attacks of tachycardia. An ECG was made at that time and it was noted that the patient was having an attack of ventricular tachycardia. One hundred milligrams of pronestyl were administered intravenously. Within 3 minutes a normal sinus rhythm was restored. The patient was placed on a maintenance dose of

0.5 gram of pronestyl by mouth every 6 hours. Four hours later and after his first oral dose of pronestyl, he developed another attack of ventricular tachycardia. Again, after the intravenous administration of 100 mg. of pronestyl, the tachycardia stopped within 1 minute and a normal sinus rhythm was restored. ECG's thereafter showed T-wave inversion in all limb leads and in leads AVF, V<sub>4</sub>, V<sub>5</sub>, and V<sub>6</sub>. The patient was continued on an oral dose of 0.5 gram of pronestyl every 6 hours. Four weeks later he had a recurrence of tachycardia, during gradual reduction of the oral dosage of pronestyl and the institution of quinidine therapy. The attack was immediately controlled by giving 100 mg. of pronestyl intravenously. With the resumption of a dosage of 0.5 gram of pronestyl by mouth every 6 hours, no further attacks occurred. Other treatment of this patient consisted of bed rest for 6 weeks and gradual ambulation. At the time of discharge, he was on a maintenance dose of 0.5 gram of pronestyl every 4 hours.

#### DISCUSSION

We believe that this patient's tachycardia was precipitated in part by the use of tobacco because he was a heavy smoker; his first attack of tachycardia in the hospital came on while he was smoking a cigarette. It is also of interest to note that he was having attacks of paroxysmal ventricular tachycardia from which he could spontaneously recover and carry on his duties for 18 months prior to admission. The T-wave changes in the ECG's showing sinus rhythm were thought to be due to myocardial fatigue although myocardial infarction was considered. The use of pronestyl appeared to control the ventricular tachycardia in this patient. When used intravenously, the drug acted rapidly to produce the desired effect. The dosage used was much smaller than usually reported. In a 2-month period of oral administration there were no apparent signs of toxicity. The experience noted herein is similar to that reported by other observers (3,4) in that quinidine failed to prevent the recurrence of attacks.

(3) Irvin, C. W., Jr., and Cutts, F. B.: Ventricular tachycardia; report of case in which "pronestyl" was effectively used after failure with quinidine. *J. A. M. A.* 146: 1282-1283, Aug. 4, 1951.

(4) Miller, H.; Nathanson, M. H.; and Griffith, G. C.: Action of procaine amide in cardiac arrhythmias. *J. A. M. A.* 146: 1004-1007, July 14, 1951.

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# Fluid Balance in Pediatrics<sup>(1)</sup>

Frederick C. Biehusen, Captain, MC, U. S. A.

C. Warren Bierman, First Lieutenant, MC, U. S. A. R.

**C**OINCIDENT with the rapid increase in the Armed Forces and the concomitant rise in dependent medical care, pediatric practice is becoming a feature of military medicine, many children being cared for at the dispensary and station hospital level by physicians without special pediatric training. The medical officer used to adults frequently finds himself at a loss on encountering fluid balance problems in children, in whom parenteral therapy is frequently required. The following concepts of fluid balance, which are taught as part of the intern teaching program of the pediatric section of this hospital, enable the house officer with limited pediatric experience to administer fluids with safety. Although dogmatic routines cannot provide optimum therapy in every situation, the procedures outlined will provide safe limits for those whose lack of experience does not provide facility to individualize.

## GENERAL PARENTERAL REQUIREMENTS

In considering the fluid needs of a child on complete parenteral therapy, it is useful to consider the relationships of total fluid volume, extracellular fluid volume, and blood volume in proportion to body weight. Recent studies indicate that from 70 to 83 percent of the bodies of premature and newborn infants are composed of water, with a gradual decrease to between 53 and 63 percent in the ages from 6 months to 11 years (2). Forty percent of the body weight of premature infants, 35 percent of that of full-term infants, and 30 percent of that of children from 1 to 14 years of age consist of water in the extracellular compartment (3). The blood volume of infants up to 1 year of age is about 8 percent of the body weight, increasing to about 8.5 percent in the ages from 1 to 13 years (4).

(1) Madigan Army Hospital, Tacoma, Wash.

(2) Fries-Hansen, B. J.; Holiday, M.; Stapleton, T.; and Wallace, W. M.: Total body water in children. *Pediatrics* 7: 321-327, Mar. 1951.

(3) Perley, A.; Forbes, G. B.; and Pennoyer, M. M.: Determination of sodium <sup>24</sup> "space" in infants, children, and adults. *J. Pediat.* 38: 299-305, Mar. 1951.

(4) Russell, S. J. M.: Blood volume studies in healthy children. *Arch. Dis. Childhood* 24: 89-98, June 1949.

**Basic requirements.** An infant needs an average of 120 cc. of water per kilogram of body weight, the need being greater in smaller infants, less in larger. He needs about 0.3 gram of sodium chloride per kilogram, an average of 1 gram per day for the infant and 3 grams per day for the child (5). Additional amounts of water and sodium chloride must replace fluids lost through the removal of intestinal secretions by gastric suction, vomiting, or diarrhea. Four grams of dextrose per kilogram of body weight is sufficient to keep the patient free of ketosis and provide for some of his basic energy requirements. If nourished for more than 2 or 3 days parenterally, from 1.5 to 3 grams of protein per kilogram of body weight should be supplied either as blood, if the hemoglobin is

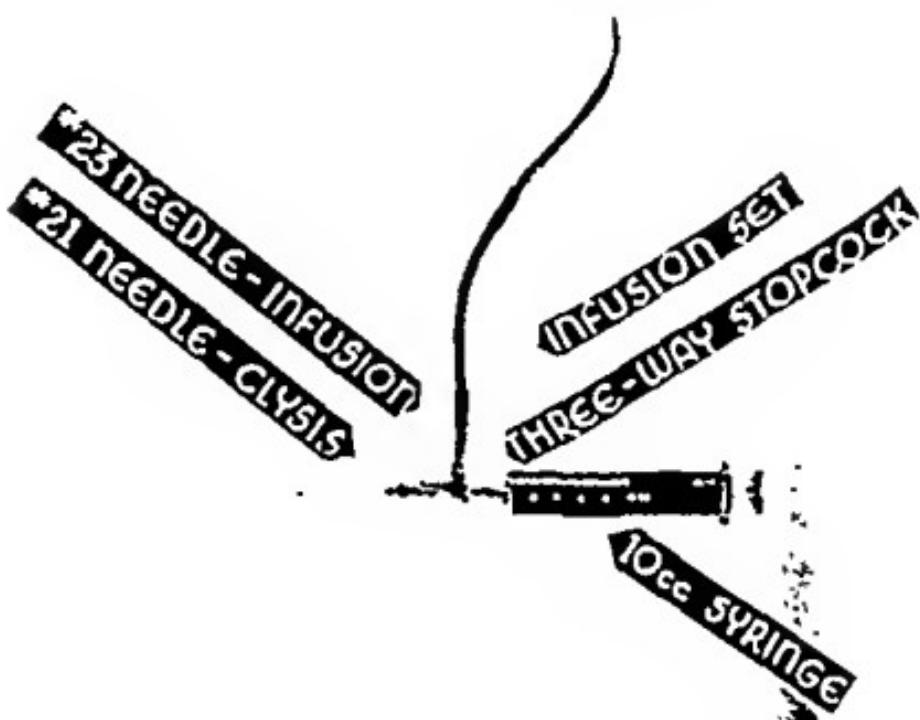


Figure 1. Apparatus for intermittent fluid administration under pressure.

low, or as salt-poor albumin, pooled plasma being avoided because of the danger of homologous serum jaundice and protein hydrolysates because they are not utilized as well as blood products. It is further desirable to provide 100 mg. of vitamin C per day either intravenously or orally and 25 mg. of vitamin K per day intramuscularly, especially if the patient has had a recent operation. One ampule of B complex vitamins may be mixed with the day's parenteral fluid requirements.

**Method of administration.** As a standard solution, a mixture of 2 parts 5 percent dextrose and 1 part normal saline solution, when given

(5) Butler, A. M., and Talbot, N. B.: Medical progress; parenteral-fluid therapy, estimation and provision of daily maintenance requirements. New England J. Med. 231: 583-590, Oct. 26, 1944.

in quantities sufficient to maintain fluid balance, provides adequate sodium chloride and dextrose and may be used either intravenously or subcutaneously. It is most important on a ward with changing nurses to mix only a 24-hour requirement at one time, especially if administration is continuous. This is a safeguard against giving too much fluid. For intermittent fluid administration, hypodermoclyses up to 40 cc. per kilogram may be given subcutaneously under pressure; infusions up to 30 cc. per kilogram may be given intravenously under pressure; transfusions up to 10 cc. per kilogram may be given under pressure with safety. Figure 1 shows a convenient and satisfactory apparatus for intermittent fluid administration. After administering a hypodermoclysis under pressure, the patient should not be left until the pink color has returned to the skin over the hypodermoclysis.

Drip hypodermoclyses and infusions have an advantage over administration under pressure in that the fluid is administered uniformly over a spaced period of time. They are potentially dangerous, however, unless carefully supervised. The doctor responsible for the patient, unless familiar with the nurses' reliability, should himself check the rate of flow frequently. Furthermore, the rate of flow and level remaining in the bottle should be recorded by the nurses every 30 minutes. If these safeguards cannot be fulfilled, we recommend spaced hypodermoclyses and infusions under pressure. Although in our hands hyaluronidase has been of little value in infants, the injection of 1 ampule of this substance into the tubing near the hypodermoclysis needles has proved of value in increasing the rate of hypodermoclysis absorption in children. Drip clyses may be run at a rate of from 4 to 8 drops per minute and drip infusions at 10 drops per minute. Up to 20 cc. per kilogram of body weight of whole blood may be given in this way to an infant at one administration and may be administered through a 23- or 25-gage needle.

Although the regimen outlined falls short of supplying minimal theoretical caloric requirements, it is adequate for the usual infant in whom total parenteral therapy is needed only for short periods. On employing these techniques recently in a newborn infant who was unable to take food or fluid by mouth because of a congenital intestinal abnormality, his general nutrition remained excellent in spite of 2 major operations. At the time of death on the twenty-eighth day of his life he was well nourished and had regained his birth weight.

#### CORRECTION OF INITIAL DEHYDRATION AND ACIDOSIS

The infant who is dehydrated and acidotic presents additional problems of initial water and electrolyte deficits plus acid-base disturbances. If laboratory facilities are available, blood should be taken immediately for chemical examination and for crossmatching. The determinations found most useful are (1) blood urea nitrogen or nonprotein nitrogen to ascertain renal status (if elevated, administer fluids cautiously); (2) carbon dioxide combining power; (3) serum chloride; (4) if facilities are available, serum sodium and potassium to determine the

status of electrolyte and acid-base balance; and (5) total protein to determine the patient's initial nutritional state.

As soon as blood is drawn the child should receive initial fluids. For initial repair a solution containing 3 parts of 5 percent dextrose, 2 parts of normal saline, and 1 part of M/6 sodium lactate (3:2:1) provides a relatively physiologic sodium to chloride ratio and an excess of water (6). In the dehydrated child, an initial infusion of 30 cc. per kilogram under pressure and a hypodermoclysis of from 20 to 40 cc. per kilogram usually provides sufficient fluid and electrolytes until initial chemical determinations are reported. When urinating, and out of shock, up to 30 cc. of whole blood per kilogram may be given to the very ill or anemic patient. After initial hydration, the 24-hour maintenance requirements mentioned above should be given and therapy should be modified on the basis of chemical determinations and the general clinical condition.

Although the usual types of dehydration resulting from diarrhoea, pyloric stenosis, and intestinal obstruction respond to this form of therapy, several metabolic disturbances, such as diabetic acidosis and salicylism, produce rather severe refractory acidoses which require more vigorous fluid therapy. In both, larger amounts of fluid, up to 150 cc. per kilogram of 3:2:1 solution should be given within the first 12 hours. If the initial carbon dioxide combining power is below 25, additional alkali in the form of M/6 sodium lactate may be given, remembering that 60 cc. per kilogram of body weight will ordinarily raise the carbon dioxide combining power by about 33 volumes per 100 cc. (7). Usually it is wise to give only one-half the calculated quantity of alkali in one administration.

Severe salicylism is frequently refractory to treatment, abnormal fat metabolism and metabolic acidosis persisting as long as an appreciable salicylate blood level remains (8). After the period of initial parenteral hydration, recovery has been expedited by offering 3:2:1 solution by mouth ad lib, within the bounds of calculated fluid requirements, in addition to continued parenteral therapy.

#### ROLE OF POTASSIUM IN PARENTERAL FLUID ADMINISTRATION

The administration of potassium must be considered when the patient has been maintained parenterally for periods of longer than 3 days, or in the recovery phase of acidosis. The known physiologic effects of potassium (9) are related largely to extracellular concentration. Clinical symptoms of potassium deficiency, associated with hypokalemia, are

(6) Chang, S. Y., and Su, T. F.: Clinical evaluation of streptomycin in treatment of bacillary dysentery in infancy and childhood. *J. Pediat.* 38: 602-609, May 1951.

(7) Hartmann, A. F., and Ergasian, J.: Treatment of diabetic acidosis. *J. Pediat.* 31: 274-299, Sept. 1947.

(8) Feldman, H. T.: Methyl salicylate poisoning. *Clin. Proc. Child. Hosp.* 6: 362-365, Nov. 1950.

(9) Hoffman, W. S.: Clinical physiology of potassium. *J. A. M. A.* 144: 1157-1162, Dec. 2, 1950.

skeletal weakness with flaccid paralysis in seriously ill patients and electrocardiographic changes associated with a lowered broadened T wave, a lengthened QT interval, a depressed ST segment, and, finally, a U wave. An elevated serum potassium, on the other hand, inconstantly produces a flaccid paralysis of skeletal muscles and has its principal effects on heart muscle, the first electrocardiographic changes being a high peaked T wave manifested at levels of about 7.5 milliequivalents per liter, progressing to a broadened QRS complex at about 9.5 milliequivalents, and complete heart block with ventricular fibrillation at levels above 10 milliequivalents per liter (10).

Clinically, in initial states of dehydration and acidosis, the serum potassium may be either normal or elevated. Only after rehydration does it begin to fall, dropping much more precipitously during recovery from diabetic acidosis than from other conditions. Until the child has been hydrated and is urinating freely, potassium should be withheld as a precaution against producing potassium intoxication. Thereafter he may be given potassium chloride solution in doses up to 20 cc. of a 1 percent solution per kilogram of body weight per day orally, or by drip hypodermoclysis if the oral route cannot be employed, but never intravenously.

#### SUMMARY

The importance of fluid balance in the young patient is of growing interest to the medical officer practicing military medicine because of the increased scope of dependent medical care. The plan of fluid therapy here presented has proved adequate for most pediatric problems. It provides for safety in the administration of optimal quantities of fluid and electrolytes.

(10) Schwartz, R.; Tomsovic, E. J.; and Schwartz, I. L.: Hyperpotassemia and body water distribution in anoxic child. *Pediatrics* 7: 516-523, Apr. 1951.

**ARTICLES BY PERSONNEL OF THE MEDICAL SERVICES OF  
THE ARMED FORCES PUBLISHED IN OTHER JOURNALS**

Phillips, R. A., Commander, MC, U. S. N.; Killough, J. H., Lt., MC, U. S. N.; Magill, G. B., Lt. (jg), MC, U. S. N., and Smith, R. C., Lt. (jg), MC, U. S. N. R.: Demonstration that para-amino-hippuric acid "enters" the human erythrocyte. Proc. Soc. Exper. Biol. & Med. 78: 315-318, 1951.

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# Myocardial Infarction Following Electric Shock

Lester E. Imboden, Lieutenant, junior grade, MC, U. S. N. R. (1)

Charles B. Newton, Lieutenant Commander, MC, U. S. N. (1)

**E**LECTRIC shock as a cause of myocardial infarction has been reported infrequently in the literature. Boas and Boas (2) refer without elaboration to electric shock as one of the causes of myocardial infarction. Vogt (3) reviewed the German literature on cardiac disturbances caused by electric shock and noted 2 patients with myocardial infarction. In 1 there was immediate substernal pain, but electrocardiographic evidence of infarction did not appear until 4 weeks later. In the other there was immediate chest pain and the patient died 24 hours following the shock. Autopsy revealed thrombosis in the left coronary artery. Koeppen (4) cited 93 patients with electrical accidents accompanied by cardiac symptoms in only 16 of whom were electrocardiographic abnormalities observed. The abnormalities were myocardial ischemia (T-wave inversion), auricular fibrillation, prolongation of the P-R interval, and the occurrence of premature ventricular beats. He applied the term "angina pectoris electrica" to the syndrome of recurrent chest pain following electric shock. The voltages to which these persons were subjected ranged generally from 220 to 50,000 and the current was of low frequency.

The psychiatric literature contains a large amount of material on the cardiac complications of electroshock therapy, the most frequent of which are minor arrhythmias, occasional serious arrhythmias, and cardiac dilatation (5, 6). These rhythmic disturbances are believed to be caused by central vagal stimulation (5). Kalinowsky and Hoch (6) stated

(1) United States Naval Hospital, San Diego, Calif.

(2) Boas, E. P., and Boas, N. F.: *Coronary Artery Disease*. The Year Book Publishers, Inc., Chicago, Ill., 1949, p. 201.

(3) Vogt, B.: Rhythmusstörungen des Herzens und anginöse Zustände nach elektrischem Unfall. *Klin. Wochenschr.* 16: 1671-1672, Nov. 27, 1937.

(4) Koeppen, S.: Die organische Angina pectoris electrica. *München. med. Wochschr.* 87: 1289-1293, Nov. 22, 1940.

(5) Jessner, L., and Ryan, V. G.: *Shock Treatment in Psychiatry; a Manual*. Grune & Stratton, Inc., New York, N. Y., 1941, p. 118.

(6) Kalinowsky, L. B., and Hoch, P. H.: *Shock Treatments and Other Somatic Procedures in Psychiatry*. Grune & Stratton, Inc., New York, N. Y., 1946, pp. 154-156.

that low tension current in shock therapy would be dangerous because the heart might be included in the field of the current. Bellet et al. (7) noted inversion of T waves in leads 1 and 2 following electric shock therapy. He also found electrocardiographic changes indicating myocardial damage in two-thirds of 58 patients undergoing insulin shock treatment. Estes and Cleckley (8) reporting on electrocarcosis noted the occurrence of gross arrhythmias, of acute congestive failure, and of a single case of severe congestive failure with transient electrocardiographic changes of myocardial ischemia. Plice and Pfister (9) studied the electrocardiographic abnormalities in 1,000 mentally ill patients and concluded that abnormal findings (especially T wave and S-T sector changes) which suggested myocardial damage often disappeared after electroshock therapy. Vast clinical experience has demonstrated the safety of high frequency electrical current as used in shock therapy.

The conduction of electric current through the body in patients with accidental shock is believed to be along the blood vessels (10). High voltage alternating current may cause intense condensation of the surrounding tissue, thrombosis, and hemorrhage (11). Gaogrene may occur in the area through which the current has passed. This phenomenon is due to an extensive endarteritis involving the endothelium and subendothelial tissues of the large arteries with resulting thrombosis. The localization of changes indicates that the blood vessels offer the least resistance to conduction as the distant surrounding tissue is not injured (12). It seems likely that myocardial infarction might be caused, in the manner outlined above, by direct injury to the coronary vessels by electric current, or in lower voltage current, by prolonged intense coronary spasm induced by electrical stimulation. Necropsy findings have also revealed petechial hemorrhages beneath the serous surfaces of the endocardium and pericardium (13-15).

- (7) Bellet, S., Kershbaum, A.; and Furst, Y. Electrocardiogram during electric shock treatment of mental disorders. *Am. J. M. Sc.* 201: 167-177, Feb 1941.  
(8) Estes, M. W., and Cleckley, H. M. Electrocarcosis in a general hospital. *Am. J. Psychiat.* 107: 814-820, May 1951.  
(9) Plice, S. G., and Pfister, C. E. Electrocardiographic abnormalities in the mentally ill, i.e. "myocardial damage" sometimes of psychogenic origin? *Illinois M. J.* 99: 212-217, Apr 1951.  
(10) Boyd, W. *Text-book of Pathology*. 5th edition. Lea & Febiger Philadelphia, Pa., 1947, p. 335.  
(11) Ellis, A. G. *Elements of Pathology*. P. Blakiston's Sons & Co., Philadelphia, Pa., 1925, p. 72.  
(12) Delafield, F., and Pruden, T. M. *Text-book of Pathology*. 13th edition. William Wood & Co., New York, N. Y., 1925, p. 12.  
(13) Karsner, H. T. *Human Pathology*. 6th edition, revised. J. B. Lippincott Co., Philadelphia, Pa., 1943, p. 7.  
(14) Cunningham, New York *M. J.* 70: 581-615, 1899.  
(15) Jelliffe, Peterson, and Haist. *Textbook of Legal Medicine*. Philadelphia, Pa., 1904, p. 245.

## CASE REPORT

A 34-year-old man was well until 1 week prior to admission on 9 April 1951 to the U. S. Naval Hospital, San Diego, Calif. On 2 April, while repairing an electric switch aboard ship, the fingers of his left hand were in contact with the metal portion of a screw driver when a friend diverted his attention and the screw driver made contact momentarily with a source of 440 volts of 60-cycle alternating current. He was stunned for about 30 seconds but did not lose consciousness. An observer stated that sparks flew from his mouth. Subsequent examination revealed that he was standing on a metal deck and that he was wearing a pair of regulation Navy shoes with worn rubber heels and leather soles that were in very poor condition. The right shoe contained an innersole but the left did not and was worn paper thin. Thus the path of least resistance was from the switch to screw driver to left arm to left foot and to the deck. The patient felt fairly well except for mild anginal symptoms, a vague sensation of fatigue, and residual numbness in the left arm and in the index and ring fingers of the left hand for about 4 days thereafter. He stated that on the third evening following the shock he did not feel entirely well during a birthday party given in his honor. About 36 hours after the electric shock, while taking a bath, he first noticed a severe pain in the left arm, left shoulder, and over the left chest. He felt his pulse at the wrist and noted that it was about 44.

The pain was practically gone the next morning but because of his not feeling entirely well he reported to sick bay where 2 ECG's were taken in the next 5 days. The second showed evidence of a posterior myocardial infarction and he was transferred to the hospital. On admission he appeared to be in no distress but was put to bed on routine coronary therapy. His liver was tender and was palpable about 2 finger-breadths below the costal margin on deep inspiration. No burned areas were noted on his hands or feet. His heart was not enlarged; the rhythm was regular; the sounds were distinct; and there were no murmurs. His blood pressure was 130/80 and his pulse was 80. His lungs were clear. His erythrocyte count was 4,800,000; his hemoglobin was 13.5 grams per 100 ml.; his leukocyte count was 6,000 with 80 percent polymorphonuclear cells, 2 percent band cells, and 18 percent lymphocytes. His sedimentation rate (Cutler) was 12. A roentgenogram of the chest was negative.

An ECG taken on 4 April (fig. 1) revealed a small  $Q_2$  and  $Q_3$  and a minute  $Q_{AVF}$ ;  $T_{V1}$  was negative. An ECG taken on 9 April, revealed a moderate  $Q_2$ ,  $Q_3$ , and  $Q_{AVF}$ . A negative  $T_3$  and  $T_{AVF}$ ; and a peaked  $T_{V2}$ ,  $T_{V3}$ ,  $T_{V4}$ , and  $T_{V5}$  (fig. 2). A diagnosis of posterior myocardial infarction was made. Subsequent ECG's on 10, 11, 16, 18, and 25 April and 2 and 23 May were unchanged except that  $T_2$  became negative and coved on 16 April and remained so. The serial electrocardiographic

changes then began with an essentially normal tracing on 4 April and progressed through deepening Q waves and Pardee-type T waves in the posterior leads and began to return to the normal pattern 7 weeks later. Serial determinations of the sedimentation rate were: 30 on 11 April; 20 on 18 April; 18 on 1 May; and 22 on 23 May.

The patient was treated routinely at bed rest with anticoagulants and recovered uneventfully except for the development of premature systoles in the seventh week of his illness. The rhythm returned to normal with the administration of procaine amide hydrochloride orally.

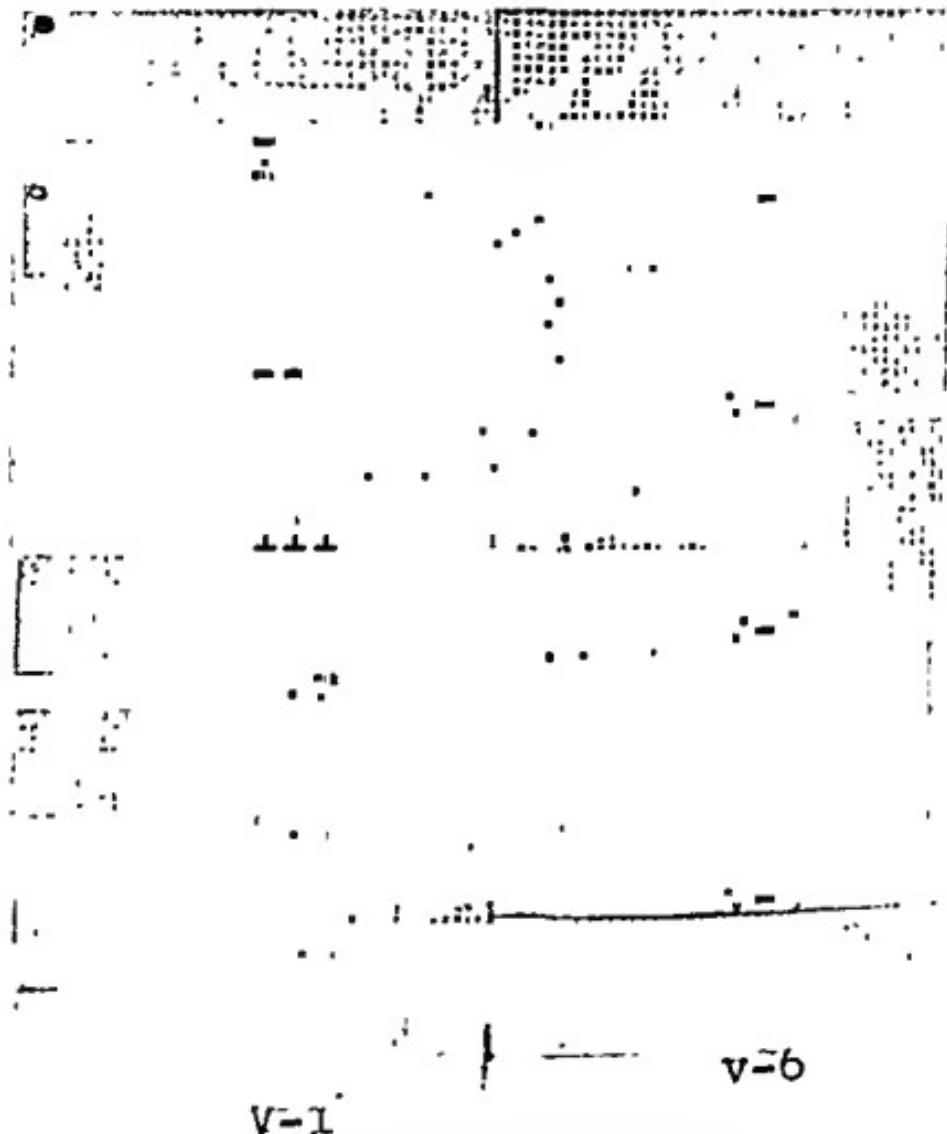


Figure 1. ECG's taken on 4 April showing small  $Q_2$  and  $Q_3$ , a minute  $Q_{AVF}$  and a negative  $T_{V6}$ .

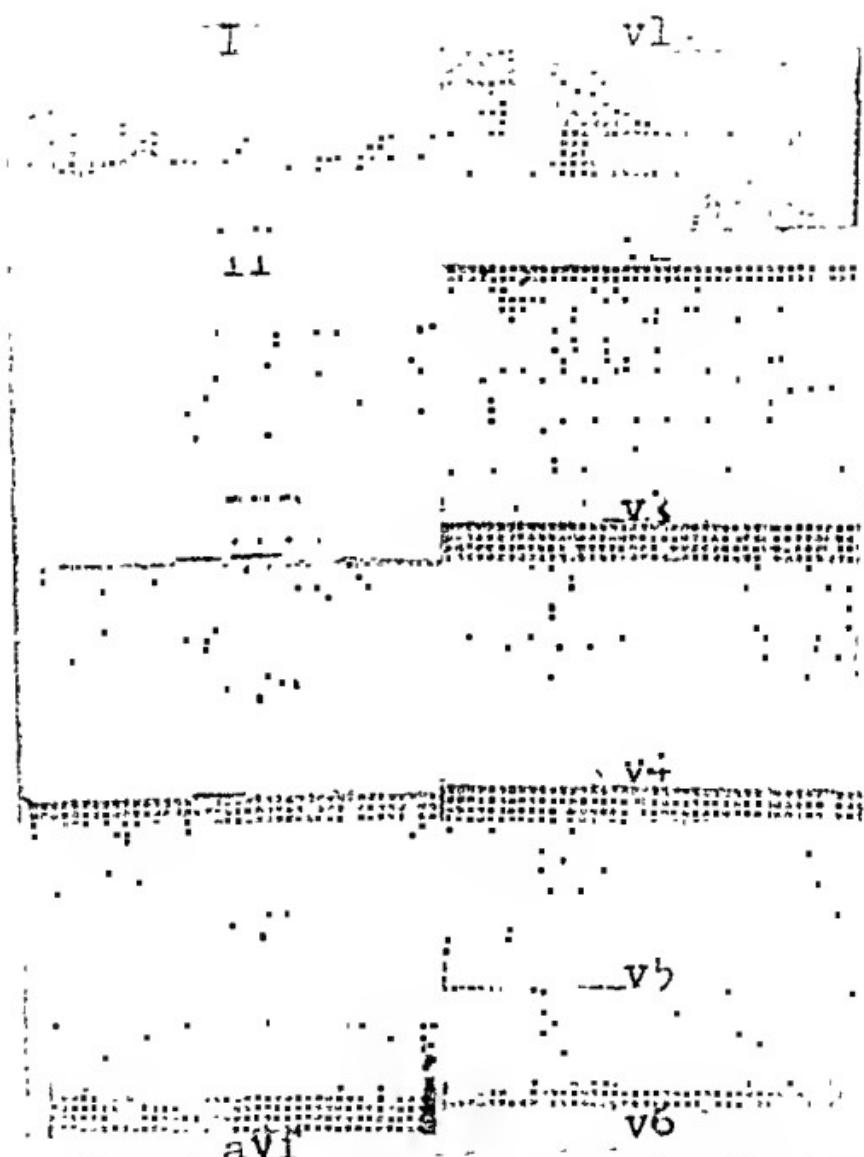


Figure 2. ECG's taken on 9 April showing moderate  $Q_2$ ,  $Q_3$ , and  $Q_{AVF}$ ; negative  $T_I$  and  $T_{AVF}$ ; and peaked  $T_{V2}$ ,  $T_{V3}$ ,  $T_{V4}$ , and  $T_{V5}$ .

**COMMENT**

In spite of the frequency of accidental electric shock in home and industry the complication of myocardial infarction is apparently rare. The patient here reported developed a myocardial infarction about 48 hours after a severe electric shock. This strongly suggests that the shock caused the infarction. Because the path of electric current through the body is along the blood vessels and severe blood vessel injury may result from electric shock it is not difficult to conceive of an electric current producing injury to or intense spasm of the coronary arteries when the heart is in the path of the current. The circumstances in this case suggested that the passage of the current was from the left hand through the body to the left foot which would quite likely include the heart in its course.

The use of high frequency current to the central nervous system in electric shock therapy has proved to be a relatively safe procedure and the cardiac complications that have occurred were undoubtedly on the basis of vagus effects on the rhythm or of overtaxing of a low cardiac reserve by suddenly increasing the circulatory requirements in convulsions. In accidental shock, however, when an electric current of low frequency passes through the body, there is a definite hazard of organic damage to the heart.

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## BOOK REVIEWS AND BOOKS RECEIVED



Publishers submitting books for review are requested to address them as follows:

The Editor

UNITED STATES ARMED FORCES MEDICAL JOURNAL,

Bureau of Medicine and Surgery, Navy Department,  
Washington 25, D. C.

(For review)

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**SENSORY MECHANISMS OF THE RETINA**, with an appendix on Electrotetrography by Ragnar Granit M. D. Director of the Nobel Institute for Neurophysiology Professor of Neurophysiology The Royal Caroline Institute Stockholm 412 pages Illustrated. Oxford University Press, New York, N. Y., publishers, 1947 Price \$11

This book primarily deals with the transformation of the study of the electrical responses of the eye into a scientific method capable of analyzing the intricate sensory mechanism of the retina. It is divided into four sections: (a) The Electrical Signs of Excitation and Inhibition of the Retina and Optic Nerve; (b) The Properties of Rods and Cones: Variations in Area, Intensity and Duration of the Stimulus in Dark and Light Adaptation; (c) The Properties of the Photosensitive Substances and the Mechanism of Excitation; and (d) Colour Reception.

Electrophysiology of the retina dates from the middle of the last century when DuBois Reymond's discovery of the negative variation in nerves and the resting potential of the eye (1840) prompted Holmgren to apply electrodes to the eye. His galvanometer gave a deflection when the eye was illuminated and another when the light was turned off. He thereupon described what is now known as the electroretinogram in a paper published in 1863. Since then knowledge in this field has proceeded hand in hand with electrophysiology in general. The development of valve amplification has enabled electrophysiology to make great strides in the last two decades. The electroretinogram is a composite curve which integrates the complex electrical responses to stimulation in the retina. Granit's great contribution to the physiology of vision has been the revelation of the processes in the retina and optic nerve underlying not only scotopic but also photopic vision. He has shown that the retinogram is the only measurable index of what takes place in the retina in response to changes in illumination. He has found two chief types of electroretinograms: the E-Retinogram which is dominated by rods; and the I-Retinogram which is dominated by cones. His analysis of the electroretinogram is the most complete and best established to date. With his micro-electric technique Granit has fully confirmed the identity of the scotopic sensitivity curve and the visual purple absorption curve with its maximum at 500 $\mu\text{m}$ ; and has shown that the photopic curve corresponds with the photopic luminosity curve with its maximum at 500 $\mu\text{m}$ . These he calls the scotopic and photopic dominator curves. These curves are further analyzed into

a definite number of curves which he calls the modulator curves. The dominator modulator theory shows that the scotopic and photopic curves are true luminosity curves, i. e. brightness differences.

The Appendix I on technical notes and Appendix II on electroretinography in man together with a large and complete reference table makes this a most valuable book for any one interested in neurologic or ophthalmic physiology. The format is excellent and the numerous illustrations consisting chiefly of graphs and charts are comprehensive and accompanied by full explanatory notes. The book should be a must for anyone working in electrophysiology and the physiology of vision but in a general medical library it would probably find a very limited use.—*Capt. W. L. Berkley (MC) U. S. N.*

**HANDBOOK OF ORTHOPEDIC SURGERY**, by Alfred Rives Shands, Jr., B. A., M. D., Medical Director of the Alfred I. duPont Institute of the Nemours Foundation, Wilmington, Del., Visiting Professor of Orthopedic Surgery, University of Pennsylvania School of Medicine, Philadelphia, Pa., in collaboration with Richard Beverly Raney, B. A., M. D., Associate in Orthopedic Surgery, Duke University School of Medicine, Durham, N. C.; Lecturer in Orthopedic Surgery, University of North Carolina School of Medicine, Chapel Hill, N. C. 3d edition. 574 pages, illustrated. The C. V. Mosby Co., St. Louis, Mo., publishers, 1948. Price \$6.

Dr. Shands first introduced this handbook in 1937 and since that time it has become a standard reference in undergraduate orthopedic instruction. It is also widely used by the pediatrician and the general practitioner, which testifies to its suitability. In this most recent revision, Dr. Shands and his co-author, Dr. Raney, have added some new material which has evolved from experiences gained in the recent war. The original form and most of the original illustrations are retained.

The book systematically covers the general field of orthopedics, including basic considerations of bone and joint infections, proceeding through the congenital deformities to the affections of growing bone, and of adult bone. The arthritides and neuromuscular disabilities are inadequately covered. Several chapters give consideration to the special regions of the musculo-skeletal systems. A brief summation of fractures is given. It is not the intention of this handbook to detail treatment, but merely to call attention to the deformities which may occur from trauma.

This book will continue to serve as an excellent outline for teaching medical undergraduates, nurses, physical therapists, and hospital corpsmen. The excellent bibliography makes it a valuable source book for the orthopedic resident and researcher.—*Commander C. R. Carr (MC) U. S. N.*

**PRACTICE OF ALLERGY**, by Warren T. Vaughan, M. D., Richmond Fa. Revised by J. Harvey Black, M. D., Dallas, Tex. 2d edition. 1,132 pages, illustrated. The C. V. Mosby Co., St. Louis, Mo., publishers, 1948. Price \$15.

This detailed second edition of a well-known classic in the field of allergy appears 9 years after the original edition. The death of the original author might have terminated the usefulness of what started as an outstanding text in this field, but fortunately Dr. Black has carried on, adding new knowledge and removing that which is no longer acceptable.

To the student new to this sphere, this volume offers what is too often missing in current texts—a keenly appreciative and revealing historical chapter. To all but those who use a book merely for rapid reference, such an introduction serves a great but intangible purpose in orientation and appreciation. This is followed in natural sequence by detailed chapters on the theories of anaphylaxis, the relation of experimental anaphylaxis and clinical allergy, terminology, and functional pathology. The discussions on the nature of allergy are particularly illuminating. The next step is a consideration in several chapters of the factors of incidence,

environment, heredity, and the growth of the allergic child, followed by three extremely detailed chapters on physiology. The psychological aspects of allergy are well covered.

The authors then move nearer the individual patient with an excellent discussion of the approach to the patient and the history of the patient's illness which is so extremely important in allergic diagnosis. All conceivable means of testing are taken up in several chapters with a very fair consideration of the pros and cons, and of the opinions of others.

Of use to those new to this field are detailed instructions relative to needles, syringes, extracts, and other material.

The rather controversial problems of food allergies are well presented and the approaches of any one authority are not unduly stressed.

Pollens, Pollinosis, and other inhalant allergies are introduced by chapters on the development and distribution of pollens, botanical aspects, and surveying methods. There are many good and extremely helpful illustrations of various plants of allergic significance. There are several chapters on various means of treatment reactions and inhalants other than pollen.

Allergies related to bacteria, fungi and animal products are considered with the same detailed approach. Anaphylactic shock, drug allergy, contact allergy, and physical allergy are well outlined. The chapter on the use of drugs in the treatment of allergy is extensive and includes the antihistaminics.

The last part of the book is devoted to the various allergic diseases in all their manifestations. A number of diseases which are of doubtful status are considered, however. There is no attempt to overwhelm the reader with arguments in favor of their allergic origin.

The book is well organized and clearly printed. One departure from many medical texts is a listing of references at the end of the book and the lack of reference numbers. While this makes the use of the references somewhat more difficult, it also makes for a more readable and nicer appearing volume.—Commander E. C. Park, Jr., U.S.N.

**ORAL AND DENTAL DISEASES.** Anatomy, Histopathology, Clinical Features and Treatment  
A Textbook for Dental Students and a Reference Book for Dental and Medical Practitioners by Hubert H. Staines M.B.M.B.S.P.D.S.R.C.S. (Eng.), Professor of Dental Surgery and Director of Dental Education, University of Liverpool; Hon. Director, Liverpool Dental Hospital; Consultant F.M.S. Maxillofacial Centres, Royal Liverpool and Broadgreen Hospitals, Liverpool; Fellow Examiner in Dental Subjects

This book is a new publication by a British author. In this voluminous work an attempt has been made to cover etiology, histopathology, clinical features, and treatment of the diseases and injuries of the teeth, their supporting tissues, the jaws, and oral mucosae.

The material presented in most chapters is brief. For example, treatment of jaw fractures covers five pages, treatment of impacted third molars covers two pages. Malocclusion of the teeth and maldevelopment of the jaws, usually written as a separate textbook, covers only 45 pages. However, an unusual feature is the comprehensive bibliography at the conclusion of each chapter, which should aid the reader to gather more material. The chapter on stains and discoloration of the teeth is well presented.

The format is good for this type of book. The illustrations are well done, especially those in color.

The author states this book is a textbook for dental students. Considering the brief and incomplete information in chapters on etiology of dental caries,

traumatic maxillo-facial injuries, and histopathology and clinical features of dental caries, its use is not recommended in American dental schools—*Commander A. Bartelle (DC) U. S. N.*

**HANDBOOK OF DENTAL PRACTICE** edited by Louis I Grossman D D S, Dr Med Dent, with 18 authors 417 pages, illustrated J B Lippincott, Philadelphia, Pa., publishers, 1948. Price \$12.

This book is intended to serve as a daily guide in dental practice and for handy reference purposes. Concise description of techniques is featured in a number of the chapters, while others are devoted principally to discussions of specialty practice problems or to the classification and treatment of various types of cases. The book is well printed and arranged and is divided into two parts, the first of which includes sections on anesthesia, caries prevention and control, oral diagnosis, and the dental practice specialties except those having to do with restorative treatment. The second part covers dental operative and prosthetic procedures, with a chapter on pedodontics. The illustrations, all in black and white, are generally good. Considering that the 18 authors were allowed only about 22 pages each, the book is not recommended as a substitute for standard texts. A surprising amount of very useful special knowledge, nevertheless, is provided by some of the contributions, notably Dr J R Cameron's tersely informative chapter on exodontics and Dr V. R. Tripozzano's chapters on partial and complete artificial dentures.—*Capt H. R. Dehney (DC) U. S. N.*

**HEADACHE AND OTHER HEAD PAINS** by Harold G Wolff M D, Professor of Medicine (Neurology) and Associate Professor of Psychiatry, Cornell University Medical College, Attending Physician, New York Hospital, New York 642 pages, illustrated Oxford University Press, New York, N. Y., publishers, 1948. Price \$12.

The symptom of headache is the most common complaint that is presented to the physician. It is frequently one of the most distressing of human discomforts but, in the past, little has been known of its nature and pathogenesis. In the past 15 years Dr Wolff and his fellow workers have intensely studied the cerebral circulation and the other pain-sensitive structures within the cranial vault. This text is an excellent summary of Dr. Wolff's work and his observations on the work of other investigators. The close observation of clinical symptomatology is noted throughout the text. The major criticism of the text is that it supposedly covers headache and other head pain, however, there is less than one page allotted to the "psychogenic" headache, and after following patients with all of the suggested diagnostic and therapeutic aids as outlined, one is definitely hesitant to say that "psychogenic" headache is found only in a small percentage of patients.

In a little over 20 chapters, Dr. Wolff covers the problem of the organic approach to headache very well. This book is an excellent reference on headache.—*Lt W. H. Houcett (MC) U. S. N.*

**NEUROPATHIC PATHOLOGY**, by T. Mark Schreiber, M D, Assistant Professor of Neuropathology and Assistant Professor of Medicine (Neurology), University of Cincinnati College of Medicine; Neuropathologist and Attending Neurologist, Cincinnati General Hospital 350 pages, illustrated Charles C Thomas, Springfield, Ill., publishers, 1948. Price \$8.75.

This second book of Dr. Schreiber's series of three on neuropathology deals in considerable detail with injuries and tumors of the central nervous system. Other short chapters on cerebral swelling, cerebral abscesses and hydrocephalus are included.

The chapters on central nervous system injuries occupy more than a third of the volume. It deals in a repetitious manner with the effects of injury on the brain as a whole rather than locally. The evolutionary principle of structural lesions and the extensive interaction between vascular supply and structural

alterations are two concepts which are emphasized. Skull fracture and superficial brain lacerations are not considered.

In the chapter on tumors, which occupies approximately one-half the book, Dr Scheinker says that his aim is to present a simplified tumor classification based exclusively upon the use of preparations stained with hematoxylin and eosin. He states this simplified scheme makes it possible for every neurosurgeon to assume full responsibility for a correct post-mortem laboratory examination, without specialized laboratory assistance and without special training in neuropathology. Although he states that rare tumors are to be omitted the discussion of subependymoma occupies twice as much space as the discussion of ependymoma. Similarly diffuse cerebral glioblastoma is discussed in greater detail than any other heading under gliomas. In the discussion of individual tumors insufficient diagnostic criteria are given and some are given undue emphasis. For instance it is stated that the most outstanding characteristic of glioblastoma multiforme is the pseudopalisade formation due to necrosis; and the characteristic tendency of the astroblasts to arrange themselves about blood vessels in typical radiating fashion is often sufficient to warrant diagnosis of astroblastoma from a hematoxylin and eosin section. It is felt that Dr Scheinker has fallen short of his mark.

The chapters on cerebral swelling, cerebral abscess, and hydrocephalus are adequate. The book is profusely illustrated. Some of the illustrations are inferior in quality, some of insufficient magnification to illustrate the point being made and some are repetitious. The references and index suffice.

—Lt B K Black (MC) U.S.A.

#### BOOKS RECEIVED

Receipt of the following books is acknowledged. As far as practicable, these will be reviewed at a later date.

POLY-SILOX STUDIES by Graffag Tyler Brown, M.D., Instructor in Clinical Medicine, Georgetown University School of Medicine, Consultant on Allergy, United States Public Health Service, Head, Division on Allergy, Doctors Hospital, Washington, D.C., with a foreword by Wallace M. Salter, M.D., M.R.C.P. (in Medicine), F.A.C.P. Director, later Clinic Clinics Consultant Army Institute of Pathology and Walter Reed General Hospital formerly Professor of Medicine, Georgetown University School of Medicine, Washington, D.C. 122 pages with 98 figures. Charles C Thomas, Springfield, Ill., publishers, 1949. Price \$5.

INTRODUCTION TO PARASITOLOGY With Special Reference to the Parasites of Man, by Asa C. Chandler, M.S., Ph.D., Professor of Biology, Rice Institute Houston, Texas, former Officer-in-Charge, Hookworm Research Laboratory, School of Tropical Medicine and Hygiene, Calcutta, India. 8th edition. 756 pages. Illustrated. John Wiley & Sons, Inc., New York, N.Y., publishers, 1949. Price \$6.

THE WORLD AS I SEE IT, by Albert Einstein. Translated by Alan Harris. 112 pages. Philosophical Library, New York, N.Y., publishers, 1949. Price \$2.75.

THE MAGIC CLOAK, A Contribution to the Psychology of Authoritarianism by James Clark Volanen, M.D. 343 pages with illustrations by Eric Loran. The Whitrose Press, Wakefield, Mass., publishers, 1949. Price \$5.

NURSING IN CLINICAL MEDICINE, by Julius Jensen, Ph.D. (in Medicine), M.R.C.S. (Eng.), L.R.C.P. (Lond.), Assistant Professor in Medicine, Washington University, St. Louis, Member of Staff, St. Luke's Hospital, St. Louis, Diplomate of American Board of Internal Medicine (Cardiovascular Disease) and Deborah MacGregor Jensen, M.A., B.Sc., R.N., Lecturer in Nursing Education, Washington University, St. Louis; Floating Instructor at St. Louis City and St. Luke's Hospital, St. Louis, formerly Social Service Consultant, Floating Nurse Association, St. Louis. 5th edition. 791 pages. The Macmillan Co., New York, N.Y., publishers, 1949. Price \$4.

**ESSENTIALS OF GYNECOLOGY.** by Leo Brady, M. D., F. A. C. S. Assistant Professor of Gynecology, Johns Hopkins University, Assistant Professor of Gynecology, University of Maryland, Assistant Attending Gynecologist, Johns Hopkins Hospital; Consulting Gynecologist, Church Home and Infirmary, Hospital for the Women of Maryland, St. Joseph's, The Union Memorial and University Hospitals, Ethna Louise Kurtz, R. N., formerly, Head Nurse, Brady Urological Institute, Johns Hopkins Hospital; formerly Supervisor, Gynecological Operating Room, Johns Hopkins Hospital, and Eileen McLanghlin, B. S., R. N., Instructor and Supervisor, Gynecological Nursing, Johns Hopkins Hospital. 2d edition 256 pages, illustrated. The Macmillan Co., New York, N. Y., publishers, 1949. Price \$3.

**MARIJUANA IN LATIN AMERICA. The Threat It Constitutes,** by Pablo Osvaldo Wolff, M. D., Ph. D., M. A., Buenos Aires, Argentina. Member of Expert Committee on Habit-Forming Drugs of the World Health Organization, sponsored by Washington Institute of Medicine. 56 pages. The Linares Press, Inc., Washington, D. C., publishers, 1949. Price \$1.50.

**PERIODONTIA. A Study of the Histology, Physiology, and Pathology of the Periodontium and the Treatment of Its Diseases,** by Henry M. Goldman, D. M. D., Chief of Stomatology and Head of the Dental Department, Beth Israel Hospital; Periodontist, Massachusetts General Hospital, Boston, Mass.; Consultant, Army Institute of Pathology, Washington, D. C. 2d edition 611 pages, with 458 illustrations including 18 in color. The C. V. Mosby Co., St. Louis, Mo., publishers, 1949. Price \$12.50.

**ATLAS OF OBSTETRIC TECHNIC,** by Paul Titus, M. D. Obstetrician-Gynecologist to the St. Margaret Memorial Hospital, Pittsburgh; Secretary, American Board of Obstetrics and Gynecology. Illustrations by E. M. Shackelford, formerly Medical Illustrator, John C. Oliver Memorial Research Foundation, St. Margaret Memorial Hospital, Pittsburgh. 2d edition 197 pages; Illustrated. The C. V. Mosby Co., St. Louis, Mo., publishers, 1949. Price \$7.50.

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**COVER PHOTOGRAPH**

*The main entrance to Tripler General Hospital, Honolulu, T. H.*

## Foreword

The UNITED STATES ARMED FORCES MEDICAL JOURNAL represents the unification of the BULLETIN OF THE UNITED STATES ARMY MEDICAL DEPARTMENT, published since 1922, and the UNITED STATES NAVAL MEDICAL BULLETIN, published since 1907. This joint periodical is the medium for disseminating information of administrative and professional interest to all medical personnel of the Department of Defense.

It is the aim to include in each issue administrative directives, original scientific and professional articles, editorial comments on current professional literature of special interest, clinical notes, descriptions of new devices and instruments, abstracts of articles from various medical periodicals, and notices and reviews of newly published professional books, of interest to all commissioned medical personnel of the Department of Defense.

The Director, Medical Services, and the Surgeons General of the several services extend an invitation to all medical officers, dental officers, Medical Service Corps officers, Nurse Corps officers, officers of the Veterinary Corps, all officers of the ancillary services of the medical services of the Armed Forces, and to the medical consultants of the Army, Navy, and Air Force to submit manuscripts for publication in this JOURNAL.

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UNITED STATES  
GOVERNMENT PRINTING OFFICE  
WASHINGTON 1950

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Yearly subscription, \$4, foreign subscription, \$5.35.

Single number, 35 cents.

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*United States Navy*

WAYNE G. BRANDSTADT, *Associate Editor,*

*Lieutenant Colonel, Medical Corps,*

*United States Army*

ALFRED A. GENTILECORE, *Associate Editor*

*Captain, Medical Service Corps,*

*United States Air Force*

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# THE SECRETARY OF DEFENSE

WASHINGTON

27 JANUARY 1949.

## MEMORANDUM FOR THE SECRETARY OF THE ARMY THE SECRETARY OF THE NAVY THE SECRETARY OF THE AIR FORCE

SUBJECT: Nomenclature and Definitions Pertaining to Fixed Medical Treatment Facilities

1. In order to effect more uniformity in the nomenclature and definitions used in the Department of Defense with respect to fixed medical treatment facilities, it is the policy of the Department of Defense to use the following nomenclature and definitions with reference to the "capacities" and the "bed status" of such facilities

### A. With respect to "capacities" of fixed medical treatment facilities

(1) *Mobilization Bed Capacity* is space for patients' beds and is measured in terms of the number of beds which can be set up in wards or rooms designed for patients' beds, spacing beds 6 feet between centers (approximately 72 square feet per bed). Former ward space which has been disposed of or has been structurally altered to serve another purpose is not included in computing bed capacities. Space for beds used only in connection with examination or brief treatment periods, such as that in examining rooms or in the physiotherapy department, is not included in this figure. Nursery space is not included in the bed capacity but is accounted for separately in terms of the number of bassinets it accommodates.

(2) *Normal Bed Capacity* or capacity for normal peacetime use is space for patients' beds and is measured in terms of the number of beds which can be set up in wards or rooms designed for patients' beds, spacing beds 8 feet between centers (approximately 100 square feet per bed). Former ward space which has been structurally altered to serve another purpose is not included in computing bed capacities. Space for beds used only in connection with examination or brief treatment periods, such as that in examining rooms or in the physiotherapy department, is not included in this figure. Nursery space is not included in the bed capacity but is accounted for separately in terms of the number of bassinets it accommodates.

### B. With respect to the use being made of the above "bed capacities" of fixed medical treatment facilities (i.e., as to the availability of beds set up and as to the status of the remaining spaces for beds):

(1) *Operating beds* are those medical treatment facility beds which are currently set up and to all respects ready for the care of patients and which the facility is staffed and equipped to operate. Bassinets for the use of newborn infants in the nursery are not included in the count of operating beds, but are accounted for separately.

(a) *Occupied Beds* is the number of operating beds in a medical treatment facility which are currently assigned to patients. It does not include any beds for patients who are on leave or absent without leave.

(b) *Operating Beds Available* is the number of operating beds in a medical treatment facility which are not currently assigned to patients.

(2) *Inactive Beds* are those medical treatment facility bed spaces with beds, not necessarily set up, for which equipment and fixtures are on hand and installed, but for which operating staff is not provided. Inactive beds may be converted to operating beds within a day or two after the necessary staff is made available.

(3) *Latent Reserve Beds* are those medical treatment facility bed spaces for which are lacking not only the required staff but also some or all of the equipment and fixtures necessary to convert them to operating beds. Maintenance repairs may be required to effect this conversion. The time required to convert latent reserve beds to operating beds will vary and may be prolonged.

It is intended that a fixed medical treatment facility operating with beds set up on 8-foot centers (approximately 100 square feet per bed) will also count inactive beds and latent reserve beds on this basis. Thus, when no space is being counted by mobilization capacity criteria, the sum of the *operating beds, inactive beds* and *latent reserve beds* is equal to the *normal bed capacity*. A fixed medical treatment facility currently authorized to set up operating beds on 6-foot centers (approximately 72 square feet per bed) will count inactive beds and latent reserve beds on the basis of 6-foot centers (by mobilization capacity criteria) and also on the basis of 8-foot centers (by normal capacity criteria).

2. The above seven (7) terms for standard use throughout the Department of Defense will supplant the larger number of nonstandard terms of this nature heretofore variously used. The use of terms having indefinite or not uniformly understood meanings, such as maximum capacity, constructed capacity, emergency capacity, authorized capacity, beds assembled and beds vacant, will thus be obviated.

3. It is requested that you take the necessary action in your departments to implement the above Department of Defense policy at the earliest possible date, so that reports for periods beginning on or after 1 April 1950 will be in conformity with the above nomenclature and definitions.

(S) LEVEN C. ALLEN,  
Major General, U. S. A.,  
Executive Secretary.

Copies furnished:

Joint Chiefs of Staff.

Chairman, Munitions Board.



# UNITED STATES ARMED FORCES MEDICAL JOURNAL

*Published monthly by the Department of Defense*

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 WAYNE G. BRANDSTADT, Lieutenant Colonel MC, U.S.A., Associate Editor  
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THE PRINTING OF THIS PUBLICATION HAS BEEN APPROVED BY THE DIRECTOR OF THE BUREAU OF THE BUDGET, OCTOBER 10, 1949

## Congestive Heart Failure

### Backward and Forward Failure Hypotheses

HENRY R. COOPER, Lieutenant (MC) U.S.N.<sup>1</sup>

**A**LTHOUGH thousands of patients have been treated for congestive heart failure, there is no universally accepted theory regarding the altered physiologic state in this condition. It would be well to define the conceptions of heart failure, circulatory failure, and congestive heart failure before beginning a general discussion of the subject. Dock (1) states:

Heart failure should be applied only to the clinical disorder which is due to the inability of the myocardium of the ventricles to maintain the requisite flow of blood to all the tissues of the body. Circulatory failure should be used for those conditions in which requisite flow is not maintained in spite of an adequate myocardium because shock, hemorrhage, pericardial tamponade, constrictive pericarditis, or extreme rates of tachycardia prevent adequate diastolic filling of the ventricles.

This indicates that in circulatory failure there is no primary weakness of the myocardium.

The term, "congestive heart failure," is applied to that syndrome in which myocardial weakness is associated with such signs and symptoms as edema, increased blood volume, increased venous pressure, and the concomitant symptoms of dyspnea and weakness. In short, con-

<sup>1</sup> U.S. Naval Hospital, Bethesda, Md.

gestive heart failure is waterlogging of the tissues in close association with myocardial weakness.

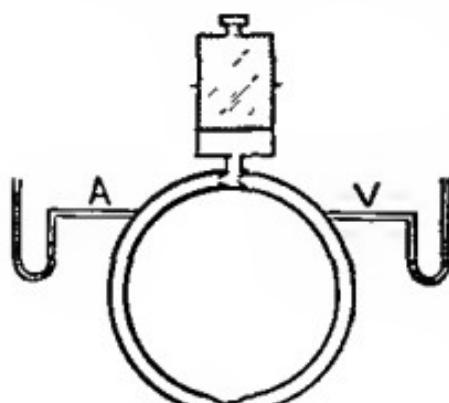
#### MECHANISM

How does this occur? In 1832, James Hope propounded the "dam and stream" analogy (2) (3). This is the basis for the so-called "backward failure" theory of congestive failure (4). The "dam and stream" analogy pictures the blood in the great veins as being a pond before a dam in a flowing stream. The heart is the pump which lifts the water over the dam. As the pump weakens more water runs into the pond than is pumped out, and the water level (venous pressure) rises (2). In other words, blood backs up behind the failing heart.

In 1859, Julius Cohnheim made the first studies on experimentally produced heart failure by injecting oil into the pericardial cavities of animals, producing pericardial tamponade. This not only gave rise to an increase in venous pressure, but also a fall in arterial pressure. Hence, he concluded that inadequate cardiac output, so-called "forward failure," played a part in the clinical syndrome as well as the "backward failure" (5). It should be noted that Cohnheim actually produced circulatory failure, according to the definition as stated before, and not congestive heart failure as we ordinarily think of it.

In the late nineteenth century the development of apparatus for the experimental study of circulatory phenomena came into vogue (2). One of the simplest forms of circulation schema is shown in figure 1 (after Starr) (2). The apparatus works as follows. Before the pump is started a pressure of 10 mm exists throughout the system. This is the static pressure. When one pumps hard the pressures become  $A=120$ ,  $V=4$ . When one pumps weakly, the pressures become  $A=70$ ,  $V=8$ . Increasing the resistance at the pinchcock increases arterial pressure but always diminishes venous pressure simultaneously; decreasing resistance has the opposite effect. Increased

venous pressure together with a maintained arterial pressure cannot be brought about by either weakening the pump, changing the resistance, or any combination of the two. Let us now inject more water into the system. This lodges chiefly in the most distensible parts, that is, the "veins." The static pressure is now 20 mm. After beginning to pump,  $A=120$ ,  $V=15$ . Increased venous pressure in the presence of a normal arterial pressure is now attained.



Courtesy of *Annals of Internal Medicine*  
Figure 1.—The simplest form of circulation schema.

About 35 years ago Starling and his associates published their work with the heart-lung preparation, from which the "law of the heart" was formulated. In brief, Starling's law states that the energy output of the heart is directly related to its diastolic volume (6).

All of the foregoing work has formed the basis for the "backward failure" theory, which has been so widely accepted that Starr (2) speaks of it as the "classical" view. It may be well at this time to state in simple terms this classic view of "backward failure." Over-work of the heart leads to enlargement, particularly of those portions of the heart which are subjected to the increase in work. If dilatation of a chamber becomes extreme, there is a rise in the venous pressure behind the chamber. This increased venous pressure leads to congestion of the organs drained by these veins. For example, in a patient with mitral stenosis, dilatation of the left auricle eventually occurs. Subsequently, increased pulmonary venous pressure and pulmonary congestion occur, followed by an increase in the pulmonary arterial pressure with consequent strain upon the right ventricle. Continuing with this line of reasoning, the right ventricle dilates, the tricuspid valve becomes incompetent, and the venous pressure in the right auricle and systemic veins is elevated. It is the increased venous pressure in the peripheral circulation that theoretically brings about the congestion and peripheral edema so characteristic of congestive heart failure.

This classical view has been accepted by most French and German clinicians since Hope's day (4). It has been clearly expressed and the conception of left and right heart failure has been carefully delineated by Harrison (5). He concludes that the clinical manifestations of congestive heart failure are due to back pressure, dyspnea being brought about by pulmonary congestion which is the result of back pressure from the left side of the heart. The peripheral edema follows congestion of the systemic circulation which is dependent on the back pressure from the right side of the heart. In both instances, the rise in venous pressure is dependent on dilatation of the chambers of the corresponding side of the heart, the dilatation being a manifestation of fatigue of the cardiac muscle. The dilated heart is an inefficient pump for, although it may supply an adequate amount of blood, it expends excess energy in carrying on this work. Heart failure should be attributed in the main to inefficiency, rather than to insufficiency, of the myocardium (5).

In the English-speaking countries, until recently, the most favored theory has been the "forward failure" of Ellis (4) ("recently" coinciding with Harrison's (5) views). In simple terms, the "forward failure" theory holds that the manifestations of cardiac decompensation are caused in the main by an inadequate output of blood by

the heart (4). In other words, the function of the heart is to pump blood to meet the metabolic requirements of the body; thus the symptoms of the failing heart are primarily caused by an inadequate cardiac output and not to an increase in venous pressure behind the failing cardiac chamber. The "forward failure" theory was advocated by Sir James MacKenzie, Sir Thomas Lewis (4), and many others. It was with the advent of the work of the Steail group (7) in 1944 that this theory again gained popularity. Steail observed that many patients showed an increase in extracellular fluid, i. e., an increase in weight, before they showed an increase in venous pressure. In other words, there is a retention of salt and water prior to the development of the increased venous pressure, which is supposedly the first phenomenon associated with cardiac failure according to the backward pressure theory.

Before entering into a more detailed discussion of the chain of events which purportedly occurs according to these two main hypotheses, we should briefly review the physiology of edema formation, blood volume regulation, changes in venous pressure, and the regulation of cardiac output by examining their relationship to congestive heart failure.

#### CHARACTERISTICS

Edema is a prominent sign associated with progressive heart failure. Fluid transfer between the capillaries and the extracellular spaces depends, in the main, upon the hydrostatic blood pressure, the plasma osmotic pressure, the tissue osmotic pressure and the tissue tension (8). Normally, the hydrostatic pressure and the plasma osmotic pressure are the most important factors (8). Edema may be caused by: (a) increased capillary permeability, as in burns; (b) increased hydrostatic pressure (hydrostatic pressure may be augmented by increased venous pressure or arteriolar dilatation); (c) lymphatic obstruction; (d) hypoproteinemia; and (e) a disturbance of electrolyte and water balance as in Addison's disease. Lymphatic obstruction and increased capillary permeability play little part in the edema of congestive heart failure. The protein content of the edema fluid in congestive heart failure is usually less than 0.5 gm. per 100 cc. (7). The protein content of lymphatic edema or transudation due to increased capillary permeability is much higher than this. It should be noted that if anoxemia causes excessive capillary permeability, this mechanism would not appear to be significant in congestive heart failure (7).

The other three causes of edema are probably operative in congestive heart failure. The capillary hydrostatic pressure may be raised by increased venous pressure and blood volume. Hypoproteinemia may also be a factor in cardiac edema as the total blood protein concentra-

tion is usually decreased in congestive heart failure for perhaps a variety of reasons, such as hemodilution, decreased protein intake, and increased protein loss (7). There is, however, not enough decrease in the total protein concentration on the whole to make this the primary cause of cardiac edema. That there is a decrease in the elimination of salt and fluid by the kidney in congestive heart failure is well known. This retention of salt is thought by Stead and his associates to be the primary factor in cardiac edema. Clinically, the earliest sign of edema formation is a gain in weight; several pounds of fluid may collect in the extracellular areas before a pitting edema is demonstrable.

It is agreed that there is an increased blood volume in congestive heart failure (5). This is principally an increase in plasma volume. In the normal resting subject with constant arterial pressure and circulating red blood cells, the plasma volume may be altered by: (a) changing the amount of circulating protein; (b) changing the capillary hydrostatic pressure; and (c) changing the extracellular fluid volume. The first two causes are easily understood. The mechanism of the third cause should be explained. If one decreases the extracellular volume by dehydration, there is also a decrease in plasma volume. Conversely, if the extracellular volume is increased by the use of desoxycorticosterone acetate, the plasma volume increases. Perhaps the best example is seen in nephrosis. Despite the extremely low plasma proteins in nephrosis, the circulating blood volume is maintained by the tremendous increase in extracellular volume, or edema (7). In congestive heart failure the extracellular volume and the plasma volume increase and decrease concordantly (7).

An increased venous pressure is characteristic of congestive heart failure. It may be brought about by: (a) obstruction to the veins; (b) vasoconstriction, as by adrenalin, paradrenal sulfate, or angiotonin (7); (c) gravity (this point is self-evident, but it should be remembered that venous pressure changes due to gravity are much greater than those caused by congestive heart failure); and (d) increase in blood volume.

Obstruction to a vein and the effects of gravity are of great importance in the localization of edema but would not of themselves be a common cause of generalized edema. Gravity causes a dependent type of edema in the cardiac patient and a periorbital edema in the nephritic patient. If an edematous nephritic patient is placed in a cardiac position, his edema becomes dependent. As Starr (2) states, cardiac patients with edema but without orthopnea may have periorbital edema.

The expanded blood volume plays a part in the increased venous pressure in congestive heart failure, but the role of vasoconstriction

is unknown (2). The volume of blood in the great veins can be increased without increasing the total circulating blood volume. This may be brought about by a redistribution of the blood from the arteries and the small vessels as by arteriolar dilatation (decreased peripheral resistance) or by increasing the tissue tension (2). The venous pressure may also be elevated as a part of a widespread general vasoconstriction as may be produced in animal experiments by asphyxia (9). These latter factors may play a part in the increased venous pressure of congestive heart failure.

It should be noted that all of the preceding factors influencing the venous pressure may be noncardiac in origin.

The relationship of the cardiac output to congestive heart failure can be noted by studying one of the simplest forms of circulation schema (fig. 1).

In general, patients in congestive heart failure have a diminished cardiac output (7) (10). However, exceptions to this (such as Graves disease, beriberi, arteriovenous fistula, Paget's disease) are well known (1). In the circulation schema, if one pumps vigorously the cardiac output and arterial pressure will rise but the venous pressure will fall. If one pumps weakly the converse becomes true. By changing the peripheral resistance the arterial and venous pressures may be changed, but never concordantly (2). The only manner in which the arterial pressure and venous pressure can both be raised simultaneously is by the injection of more fluid into the system. This additional fluid naturally goes to the most distensible portions of the system—that is, the veins—and the over-all static pressure is increased. Static pressure is that which exists throughout any circulatory system when the pump is not working. After the static pressure has been increased by the injection of additional fluid, the arterial pressure rises, but the venous pressure falls when the pump is started (2). However, the venous pressure is still higher than it was before the addition of the extra fluid.

Stead, Warren, and Brannon (11) studied the cardiac output in patients at rest with congestive heart failure. They found the following combinations to exist:

(a) Cardiac output low with failure, remains low with the disappearance of symptoms. Symptoms relieved by sodium restriction and continued use of diuretics.

(b) Cardiac output low with failure, increases with compensation.

(c) Cardiac output normal with failure, remains normal with compensation. Decompensation develops with increased activity.

(d) Cardiac output high with failure, falls with compensation. This combination may be shown by restless, apprehensive dyspeptic patients whose output is adequate for rest but inadequate with mild

exertion, or by patients with hyperthyroidism, anemia, arteriovenous fistula, patent ductus arteriosus, beriberi, and certain infections (11).

From the foregoing it is seen that the degree of cardiac output has no direct relationship to the degree of congestive heart failure, and that the venous pressure is no reliable index of cardiac strength or weakness (2).

#### THE "BACKWARD FAILURE" HYPOTHESIS

The "backward failure" theory states that increased venous pressure is the first sign of myocardial failure and that increase in blood volume, edema, and renal retention of salt and water all follow the increase in venous pressure. It seems reasonable to believe that as the heart fails and dilates, and residual ventricular blood accumulates, there will be a slight increase in central venous pressure (12). However, it is quite doubtful that this elevation of central venous pressure is of sufficient magnitude to account for the other characteristics of congestive failure. Altschule (13) (14) quotes Smirk as stating that the venous pressure commonly found in cardiac decompensation is not in itself sufficient to produce pitting edema. Further, if the initial increase in venous pressure is the cause of cardiac edema, then we would expect the blood volume to decrease as the shift of fluids to the tissues takes place; actually the blood volume is increased. It has been suggested that a high venous pressure causes kidney dysfunction resulting in edema, but raising the venous pressure to the degree seen in early congestive failure, does not decrease the renal blood flow or inhibit excretion of salt and water (12). In any case, if this sequence of events is correct, then it should be possible to experimentally produce a rise in venous pressure by damage to the heart. The only way the pressure pattern found in clinical congestive failure can be reproduced in the circulation schema is by increasing the fluid volume.

Starr (2) sums up this type of work in experimental animals as follows:

Increased venous pressure at rest may be caused by constriction of the blood vessels and by increased blood volume, even though the heart is organically sound; and it follows cardiac tamponade, as it must if the heart is to be filled at all. But direct damage to the heart muscle of an intact animal does not cause it as long as the animal is at rest, and therefore increased venous pressure at rest is not the direct consequence of cardiac weakness.

Clinically, the most common example of severe myocardial damage infrequently attended by increased venous pressure or congestive heart failure is myocardial infarction. Yet we hesitate to give intravenous fluids in coronary occlusion for fear of precipitating heart failure. This is a clinical example of the necessity of having an extracardiac

factor present, i. e., increased blood volume associated with a weak heart before congestive failure can occur. If increased venous pressure is the initial sign of a damaged myocardium, it should appear more frequently in myocardial infarction than it apparently does. Dock (1) points out that in young vigorous men the normal blood volume is relatively large, and it is in this group that we may see sudden failure following myocardial infarction; whereas in older patients with relatively small blood volumes this does not occur so frequently.

If increased venous pressure is the primary cause of pulmonary edema, then clinically we would expect to see such edema most frequently in that group of patients having the highest venous pressure in the pulmonary circuit. However, as Dock points out in mitral stenosis one frequently observes that the lungs may be free of râles even after right heart failure has set in and the liver is enlarged. We know that these cases of mitral stenosis have been walking about for years with extremely high pulmonary pressures. In animal experiments, Visscher (12) was unable to produce pulmonary edema by obstructing the pulmonary veins. Perhaps increased vascular thickening or increased lymph flow plays a part in decreasing the formation of pulmonary edema in mitral heart disease.

Warren et al. (7) performed a very simple clinical experiment in order to determine whether the venous pressure was the initial feature in the chain of events following a failing heart. They first treated congestive heart failure patients with bed rest, low sodium diet, and mercurial diuretics. After the patients were controlled, bed rest was continued but mercurial diuretics were withheld. Then a high sodium diet was administered, and frequent observations of weight, blood volume, and venous pressures were recorded. They found a definite increase in weight and blood volume prior to a rise in venous pressure. Starr (2) has noted this series of events, also.

Therefore, if a rise in venous pressure is not the primary manifestation of the failing heart, we must look elsewhere than the "backward failure" theory for an explanation of the mechanism for congestive heart failure.

#### THE "FORWARD FAILURE" THEORY

At the present time the chain of events as expressed by Starr and similarly by Stead et al. to explain the mechanism of "forward failure" is essentially as follows. Impaired cardiac function, retention of salt and water; increased blood volume; and then venous congestion. In association with this chain of events there is hemodilution, and both a decreased hematocrit, and decreased percentage of circulating proteins. Merrill (13) has shown that the renal blood flow in the presence of congestive heart failure is greatly reduced and that the filtration

tion rate is also reduced. He has reported that the retention of salt by the kidney resulting in the edema of congestive heart failure is caused by a low filtration rate and not by an increased reabsorption of salt. The renal blood flow was found to be reduced to about one-fifth of normal when the cardiac output was reduced only to about one-half of normal, indicating a specific diversion of blood from the kidney. Merrill believed that when the cardiac output became inadequate to meet the metabolic demands of the body ("forward failure") the blood may be diverted from the kidneys to other parts of the body having greater metabolic needs. He further found that there was no correlation between renal blood flow and venous blood pressure. The mechanism of congestive failure may be explained as follows:

(a) *Heart disease.*—Myocardial dysfunction is the most common denominator of congestive heart failure.

(b) *Renal retention of salt and water.*—If heart disease is progressive, a time will come when the cardiac output is insufficient to meet the demands of the body. This inadequacy, everything else being equal, would be most likely to occur first under excessive metabolic demands, i. e., the signs of the slowly failing heart should first become apparent on exercise anemia, severe infection, or other complications. The cardiac output would thus be adequate for the body at rest but inadequate under excessive metabolic demands. Clinically, such a situation certainly appears to exist, for many patients, if not most, will compensate on bed rest alone unless the heart disease is rapidly progressive.

If the cardiac output is insufficient to meet the metabolic demands of the body, what homeostatic compensatory mechanisms are available to aid in the adjustment of the inadequate heart? The blood circulation may be augmented by speeding the rate, as in anemia or beriberi, or by increasing the total blood volume. In situations in which the circulatory rate is primarily increased the failure that develops is of high output type; with compensation the cardiac output falls. The clinical examples of increased metabolism in which the total blood volume is increased apparently as a compensatory mechanism, occurs in hyperthyroidism, and in pregnancy where the metabolic demand must be high. Perhaps it is this compensatory mechanism which develops in cases of congenital heart disease. A compensatory blood volume increase also occurs in the polycythemia of high altitudes. If the cardiac output is inadequate the body may compensate by increasing the circulating medium.

Dock (1) states:

When decrease in cardiac output is due to shock or hemorrhage, the immediate effect of changes in the tone of venules and arterioles is to bring venous pressure back toward normal, and to shift the balance of fluid change between blood and

tissues towards the intravascular side. Thus blood volume tends to increase by hemodilution unless the patient is dehydrated.

This temporary mechanism in shock is not sufficient to explain the blood volume changes in congestive heart failure. Obviously, if salt and water were retained by the kidneys, the blood volume would be increased, and certainly in congestive heart failure urinary excretion is decreased. As a part of the compensatory mechanism to maintain or expand the blood volume the kidney may reabsorb sodium. It is axiomatic that if either sodium or chloride or water is retained primarily, the others will be retained to maintain electrolyte balance (7). Peters (16) states that the kidney manages salt and water excretion or retention in the following manner. As approximately 180 liters of isotonic glomerular filtrate pass through the proximal tubules per day, 60 to 80 percent of the water, all the glucose and fractions of other solutes are removed, together with a quantity of sodium and chloride. A hypotonic solution is left, but the sodium to chloride ratio, previously about 1:3, is now 1:1—as the sodium bicarbonate has been reabsorbed leaving the remaining sodium as sodium chloride. In the loop of Henle a variable amount of sodium chloride is withdrawn with some water, however, more salt than water is reabsorbed here, leaving a hypotonic solution. Finally, in the terminal convoluted tubule water is absorbed to yield the fully elaborated urine which is usually hypertonic. The renal reabsorption of water in the terminal tubule appears to be chiefly controlled by the antidiuretic hormone of the posterior pituitary. However, in the presence of an excess amount of salt this hormone will not cause an increased reabsorption of water. In other words, the salt demands water for excretion and has a functional or osmotic priority for water over the hormone. Therefore, when the body needs to retain fluid it must retain salt, for the terminal tubules, although stimulated by the posterior pituitary, cannot reabsorb water in the presence of excess salt. Thus, as a compensatory mechanism to expand the blood volume we would expect the kidneys to reabsorb sodium first and water secondarily. It is believed that part of the mechanism of sodium reabsorption is governed by the adrenal cortex, although other factors are probably operative, such as the enzyme system in the distal renal tubular cells. That sodium is the important factor is demonstrated by the action of mercurial diuretics. Reaser and Burch (17), using radioactive  $\text{Na}^{22}$ , demonstrated that in a mercurial diuresis the excretion of sodium preceded the water diuresis by 2 to 4 hours. Regardless of whether the retention of salt and water is caused primarily by decreased renal blood flow or to hormonal or enzyme factors, the important point is that a renal mechanism exists through which compensatory changes in blood volume may be made.

(c) *Increased blood volume* follows renal retention of salt and water.

(d) *Edema formation*.—As a result of increased blood volume there is an increase in hydrostatic pressure. (Starr (2) demonstrated an increase in hydrostatic pressure by measuring the venous pressure after death in patients who had succumbed to congestive heart failure.) With the increase in hydrostatic pressure transudation of fluid would occur.

(e) *Increased venous pressure*.—With the increased blood volume and increased tissue tension due to edema, two of the main causes of increased venous pressure would be present. Venous congestion would thus result. As the blood volume and extracellular fluid vary concordantly in congestive failure, the more edema present the greater the increase in blood volume and the greater the increase in venous pressure.

(f) *Increased work of the heart*.—According to Starling's law, the greater the venous pressure and diastolic filling of the heart, the greater the cardiac output. Hence, all of the foregoing events, from the renal retention of salt and water to the increase in venous pressure, are compensatory mechanisms which augment the cardiac output necessary for the adequate blood supply of the body. However, as Starling demonstrated, the metabolism of the myocardium is directly proportional to the diastolic volume (6). This increased metabolic need of the heart would lead, in the presence of progressive myocardial disease, to additional heart damage.

(g) *Additional heart damage*.—With progressive myocardial disease the foregoing series of events would be compounded and eventual, irreversible congestive heart failure would occur.

As an example, let us apply the preceding chain of events to cases of hypertensive heart disease with beginning failure of the left ventricle. The first signs of failure should occur with an increase in the basal metabolic rate. Many hypertensive patients can be up and about all day with little difficulty until they assume the decubitus position at night. However, because of inadequate output during the day, renal blood flow and sodium excretion are decreased, and the compensatory increase in blood volume occurs. Dock (1) states that these changes occur in normal subjects when kept in the upright position, which in itself reduces cardiac output by trapping blood in the distended veins below the diaphragm. Thus in these patients there is an increased blood volume which they do not need when they retire at night, for the cardiac output is then adequate to meet the basal metabolism during sleep. There is a consequent shift of intravascular fluid to extravascular areas, localization to the pulmonary circulation being favored by the tremendous pulmonary capillary bed and gravity.

There is a normal shift of venous blood to the thorax on assuming the recumbent position. This accounts for the reduction in vital capacity of approximately 8 percent found in normal persons when they lie down (5). In orthopneic congestive heart-failure patients the vital capacity is reduced an average of 25 percent by this position.

In addition, there are factors that probably favor increased right ventricular and lessened left ventricular output. During inspiration the output of the right heart is relatively greater than the output of the left heart (6). Further, it is recognized that inspiration is an active process and expiration a passive process, the latter being therefore greatly influenced by gravity and position. It is possible that in the recumbent position the right ventricular output tends to be relatively greater than the left.

Courand states

The volume of blood contained in the pulmonary vessels is governed by the relative discharge of the two sides of the heart which are under the control of the dynamic changes in the systemic circulation.

Also,

The capacity and the flexibility of the small vessels in the lungs are such that a several-fold increase in blood flow may be accommodated with negligible pressure changes.

When the hypertensive patient with left ventricular failure lies down, because of his increased blood volume the previously mentioned factors cause an abnormally large shift of fluid to the pulmonary circuit. As a large amount of fluid can be retained in the lesser circulation before a rise in pressure occurs, one may postulate that sudden pulmonary edema would ensue in the presence of a reduced vital capacity before an increased pulmonary venous pressure would bring about a compensatory left ventricular output. That this mechanism of paroxysmal nocturnal dyspnea is correct is supported by the fact that usually the patient gains immediate relief from the symptoms by merely sitting up and breathing deeply. In so doing he increases his vital capacity and cardiac output. Patients with mitral stenosis seldom undergo this sudden nocturnal pulmonary edema because their pulmonary pressure is already elevated, and pronounced differences of cardiac output are not produced in such an abrupt fashion (6).

From the foregoing discussion of congestive heart failure it is apparent that the compensatory increase in blood volume is a long-term adaptation phenomenon which, although useful to a point, becomes deleterious in the end (12). Dock (1) gives the background of this compensatory mechanism as follows:

The rise in arterial pressure in heart failure and all the classical features of congestive failure are due to the fact that mammals have developed a complex and effective mechanism for dealing with a decrease in cardiac output occurring

in shock, hemorrhage, and dehydration, and that this mechanism comes into play whenever the cardiac output is reduced for any reason whatever. Without such a mechanism, heart failure would result only in fatigability, or if severe, in anuria and abdominal distention, weakness and syncope. The mammal evolved no reflex mechanism for dealing with myocardial failure as such, for the obvious reason that wild animals do not have heart failure during the normal reproductive life span. In civilized man the development of congestive failure is hastened by the high salt content of the diet, which makes possible rapid increases in blood and intercellular fluid volume, and by alternation between an erect posture, which diminishes cardiac output, and recumbency, which allows blood and edema fluid in the legs to be mobilized and pile up in the lungs.

#### SUMMARY

The chain of events in the "forward failure" theory of heart disease may be outlined as follows: inadequate cardiac output, renal retention of salt and water, compensatory increase in blood volume, edema, elevation of venous pressure, increased ventricular diastolic volume, and temporarily increased cardiac output. In the presence of progressive myocardial disease, eventual, irreversible failure.

It is believed that the basic mechanism of chronic congestive heart failure is most compatible with the hypothesis of "forward failure." The "backward failure" features, although certainly operative to some degree, are not primary. A proper conception of the pathogenesis of this syndrome is necessary, for although little can be done for the cardiac factors involved, much may be done for the noncardiac factors, such as retention of salt and water and compensatory increase in blood volume. As Starr (2) points out, "factors directed to the elimination of fluid are becoming more and more successful in handling these cases and we are only at the beginning of our knowledge of this subject."

Clinically we are now seeing an increasing number of patients in whom, because of the restriction of salt and the use of mercurial diuretics, the classical signs of congestion and edema in the presence of an inadequate cardiac output are held in abeyance. In this group of patients the paramount limiting factors on activity are weakness and fatigue (14).

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COMPARISON OF DIFFERENT REGIMENS IN THE TREATMENT OF HEPATIC CIRRHOSIS, by Gordon R. Morey, M. D., and Robert M. Kark, M. D. Journal of Laboratory and Clinical Medicine 34: 1727-1728, Dec. 1949.

Clinical, laboratory, and metabolic observations were made on patients with hepatic cirrhosis during treatment with different therapeutic regimens. All of the patients improved on a diet which contained (a) calories equivalent to twice the calculated basal requirement; (b) 25 gm of protein per kilogram of body weight, and (c) 30 percent of the calories as fat. The patients' clinical improvement was accelerated by daily intravenous infusions of a mixed amino-acid solution which was sodium-free. Restriction of the sodium intake below 1 gm per diem was a valuable adjuvant in combatting fluid retention. No clinical benefits were observed when the basic regimen was supplemented with cystine, methionine, choline, B complex vitamins, or parenteral liver extract. The infusion of large amounts of serum albumin was impractical as a method of protein supplementation even though a transient rise in serum albumin concentration and an increase in positive nitrogen balance attended its administration. On diet, salt restriction, and supplementation with amino-acid infusions all of the patients showed weight gains without fluid retention — *Abstract*



# Obesity as a Problem in Preventive Medicine<sup>1</sup>

WELDON J. WALKER, Lieutenant Colonel, MC, U. S. A.<sup>2</sup>

THE greatest problem in preventive medicine in the United States today is obesity. It has exceeded the combined total of the four next most common causes for rejection on medical grounds of applicants for standard life insurance (1). Table 1 shows the ideal height and weight for men and women. These weights approximate the average found in adults of medium frame between 25 and 30 years of age. To obtain ideal weights for persons with small frames subtract 5 percent and for those with large frames add 5 percent. This table makes no age distinction for adult groups because those tables that indicate progressively increasing weight with advancing years merely reflect the increasing incidence of obesity with age. As a matter of fact, there is a progressive diminution of muscle mass after the age of 25 years (2). The body weight should, therefore, be less at 50 than at 25 years.

TABLE 1.—Ideal weights for height for adults of medium frame<sup>3</sup>

Height (with shoes)	Weight in pounds (as ordinarily dressed)	
	Men	Women
5 feet		116
5 feet 1 inch		118
5 feet 2 inches	129	121
5 feet 3 inches	132	124
5 feet 4 inches	135	128
5 feet 5 inches	139	131
5 feet 6 inches	142	135
5 feet 7 inches	145	139
5 feet 8 inches	150	142
5 feet 9 inches	155	146
5 feet 10 inches	158	150
5 feet 11 inches	162	153
6 feet	167	157
6 feet 1 inch	172	—
6 feet 2 inches	178	—
6 feet 3 inches	183	—

<sup>1</sup> After "Ideal Weights for Men," Statistical Bulletin, Metropolitan Life Insurance Company, 24: 6-8, June 1913, and "Ideal Weights for Women," Statistical Bulletin, Metropolitan Life Insurance Company 23: 6-8, Oct 1942.

<sup>2</sup> Read before the Medical Association of the Isthmian Canal Zone, 18 January 1949.

<sup>3</sup> Gorgas Hospital, Ancon, C. Z.

Tables 2 and 3, and figure 1 show that excess weight is a health hazard that carries a much greater risk in persons beyond 45 years of age than in younger persons. In fact an excess of 50 pounds at 45 increases mortality as much as valvular heart disease (3). The most favorable weight at this age is appreciably below that given in the standard tables. The preceding comparisons, unfavorable as they are to overweight persons, are based on the best of the group, namely life insurance policyholders, who had been selected by medical examination as free from any other serious physical impairment. If all overweight persons were included, their decreased longevity would be even more pronounced.

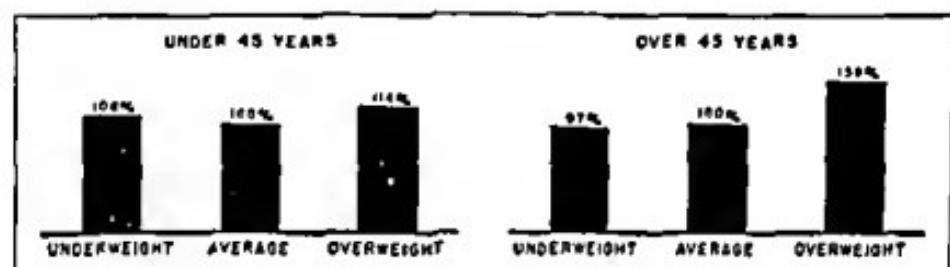


Figure 1.—Influence of weight on mortality as modified by age. (Adapted from (Newburgh (18).)

TABLE 2.—Influence of weight on mortality in insured persons<sup>1</sup>

Weight	Deaths per 100,000	Percent of standard
Standard	844	100
Underweight total	845	101
Overweight total	1,311	132
Underweight, 5-14 percent	853	99
Underweight, 15-34 percent	933	108
Overweight, 5-14 percent	1,027	122
Overweight, 15-24 percent	1,215	144
Overweight, 25 percent or more	1,472	174

<sup>1</sup> After "Length of Life," by Dublin and Lotka, (1).

TABLE 3.—Influence of overheight on mortality in persons aged 45 to 50 years<sup>1</sup>

Overheight	Increased mortality (above average) percent
10 pounds	8
20 pounds	18
30 pounds	29
40 pounds	45
50 pounds	56
60 pounds	67
70 pounds	81
80 pounds	116

<sup>1</sup> From "Obesity" by Newburgh, (18).

There are numerous diseases that show an increased mortality in overweight persons. These are chiefly the chronic degenerative diseases. Figure 2 shows the influence of weight on the mortality from cardiovascular renal disease. Insurance studies have shown sustained hypertension to occur more than three times as often in overweight persons as in others (4). A recent study involving 22,741 Army officers covering a 10-year period showed 2.5 times the incidence of hypertension in the overweight group (5). An even more startling correlation is seen between obesity and diabetes (fig. 3). Americans are not only the best fed people in the world, but they also have the highest death rate from diabetes of any country (6). At present there are about 2 million diabetics in the United States (7). It is estimated that one-half could be removed from this roll by weight reduction (8). If the present trend continues 3,873,000 persons who are living in 1940 either have or will develop the disease (9). Between 1900 and 1943 diabetes rose from twenty-seventh to eighth place as the primary cause of death in the United States despite the discovery of insulin (10). There is also a greater incidence of cancer in the obese person (11). The mortality from surgical procedures is higher in the overweight. Deaths from accidents are more frequent—when the fat man falls he falls harder. The incidence of biliary tract disease, joint disease, intertrigo, varicose veins, and hernia is also increased. The greater number of suicides does not agree with the common belief that the fat man is by nature jolly (14).

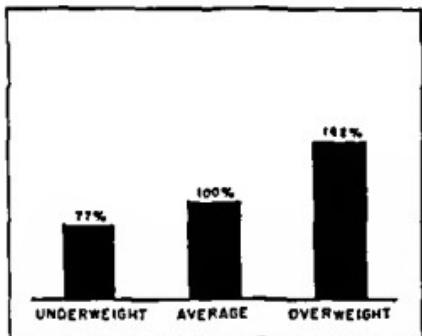


Figure 2.—Influence of weight on mortality from cardiovascular renal disease. (Adapted from Dublin and Lotka (12).)

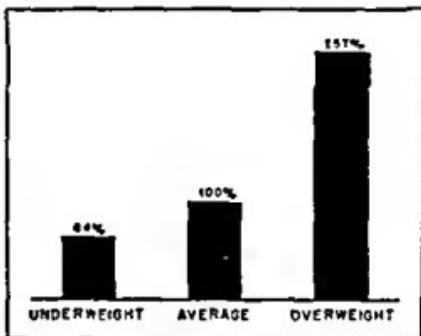
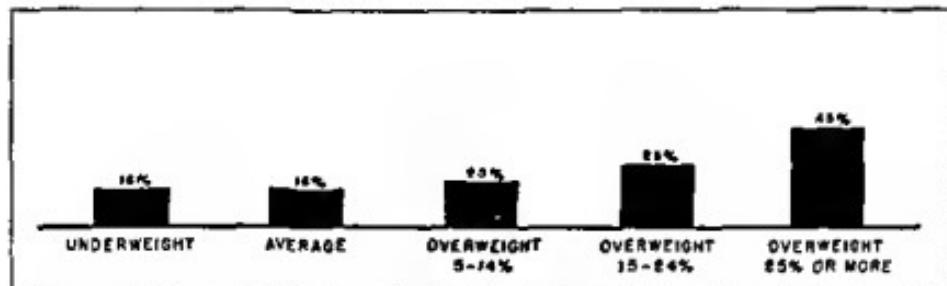


Figure 3.—Influence of weight on mortality from diabetes. (Adapted from Dublin and Lotka (12).)

*Incidence of obesity.*—In one study 2.1 percent of the men and 4 percent of the women applying for life insurance were rejected for any insurance for this reason (12). In a study of insurance policy-holders, obesity was defined as more than 20 percent above the average weight. Under 25 years of age the incidence was 4.9 percent with



*Figure 4—Relation of weight to hypertension in 594 employees of the Panama Canal. (Hypertension considered to be blood pressure of 140/90 or above.)*

a progressive increase to 19.8 percent at age 55 (13). The incidence in persons over 60 years of age dropped off presumably because few obese persons live beyond that age (14). In January 1949, 594 male employees of the Panama Canal received their annual physical examination. The incidence of overweight found is shown in table 4. The incidence of obesity in this group increased, progressively with age, from 7 percent between 21 and 24 years to 28 percent between 55 and 62 years. The correlation between increased weight and elevated blood pressure is shown in figure 4. Although single elevated blood pressure readings are found in many persons who do not have sustained hypertension the importance of transient hypertension as a forerunner of sustained hypertension is well known and this study demonstrates a significant increase of elevated blood pressure with increasing weight.

*TABLE 4—Weight distribution of 594 employees of the Panama Canal<sup>1</sup>*

15-24 percent underweight.....	---	---	---	---	---	10
5-14 percent underweight.....	---	---	---	---	---	67
Plus or minus 5 percent of the average weight.....	---	---	---	---	---	159
5-14 percent overweight.....	---	---	---	---	---	154
15-24 percent overweight.....	---	---	---	---	---	123
25 percent or more overweight.....	---	---	---	---	---	79
Percent of employees overweight.....	---	---	---	---	---	60
Percent of obese employees <sup>2</sup> .....	---	---	---	---	---	21
Average number of pounds overweight in overweight group.....	---	---	---	---	---	28
Average number of pounds overweight in obese group <sup>2</sup> .....	---	---	---	---	---	41
Expected increased mortality in overweight group.....	---	---	---	---	---	26
Expected increased mortality in obese group.....	---	---	---	---	---	50

<sup>1</sup> Ages ranged from 21 to 62 years. 55 percent were 45 years old or older.

<sup>2</sup> Persons more than 20 percent above the average weight.

*Cause of obesity.*—Although studies published 25 years ago pointed out the high mortality associated with obesity there was little medical interest in the subject largely because of the widespread belief that obese persons had some ill-defined glandular or metabolic disturb-

ance that caused them to be fat, regardless of what they ate (3). Recent studies, particularly those by Evans (2) and Newburgh (8), have established the fallacy of such beliefs. Obesity always results from the ingestion of more calories than are expended. Many obese persons state that they eat little or nothing and continue to gain. Their intake may be small in volume but not in calories. Evans (2) hospitalized a group of such patients and instructed them to continue to eat as they did at home. Their intake averaged 2,570 calories per day, and yet there was an average weight loss of 2 pounds in 4 days.

The term endocrine obesity is inaccurate. Obesity may occur in association with endocrine disease and is produced in the same way as any other obesity. Although it is known that hypothyroidism is characterized by impaired absorption of food from the intestines and that myxedematous patients are not generally obese, the idea persists that hypothyroidism is a cause of obesity (15). Plummer (16) studied 200 persons suffering from various grades of myxedema and found 61 percent were overweight. The greatest excess weight corresponded, however, to the least depression of metabolism, and those patients whose basal metabolic rates were lowest weighed the least. A few days treatment with thyroid extract resulted in diuresis with loss of edema after which their group weight was less than normal. A certain percentage of fat persons and an equal percentage of slender persons will show basal metabolic rates in the range of -10 to -30. Unless there is an associated reduction of organic blood iodide, this probably represents their normal metabolic level and is not an indication for thyroid hormone therapy (17). To attribute obesity to hypofunction of the anterior pituitary is hard to rationalize in view of the severe ephexia that results from destruction of this gland. The buffalo hump and protuberant abdomen of adrenal cortical hyperfunction have been shown to be totally unrelated to adiposity, and to result from demineralization with shortening of the vertebral column (18).

Although lesions in the hypothalamus of experimental animals result in increased appetite that leads to adiposity (19), in man a positive correlation between obesity and lesions of the hypothalamus has not been established (21). It has also been claimed that fat persons digest and absorb their food with greater than normal efficiency. Such claims have been refuted (22).

The causes of obesity, therefore, are those factors that lead to excessive caloric intake. Overeating is largely a habit, both as to the amount and type of food eaten. This seems to be the largest factor in the familial incidence of adiposity. In one study patients who were given a bulky diet containing one calory per gram lost weight

(24). When given a diet containing 2.5 calories per gram all gained weight. This suggests that we become accustomed to a habitual volume of food. The importance of psychologic factors in obesity is gaining recognition. Menopausal obesity is probably a manifestation of increased leisure and boredom as well as increased nervous tension. Many persons grow fat because life has become more difficult for them and they obtain temporary solace in eating; like the alcoholic who drinks because life is too hard. In a study of 200 obese persons, Freed (25) found that 40 percent had enuresis as children and a high incidence of delayed emotional maturity. Any type of nervous tension can be an important causal factor.

#### CASE REPORT

A 24-year-old woman had had a normal weight until 1 year after marriage when her husband was ordered overseas. She had been an orphan was emotionally immature, and became depressed and extremely lonesome. When her husband returned 2 years later she had gained nearly 100 pounds. She decided her husband was ashamed of her because she was fat. She was unhappy, had frequent crying spells, consoled herself by eating, and continued to gain weight. She was treated by multiple glandular preparations including anterior pituitary extract and testosterone. When she did not improve she was hospitalized as a refractory endocrine problem. During the course of her study, the results of which were normal from a metabolic standpoint, a 600-calorie diet was prescribed and she lost 40 pounds in 2 months. In the first week of treatment she had fainting spells that she attributed to lack of food. Her blood glucose was always normal at these times. Enough dextro-amphetamine sulfate was given to produce anorexia and the attacks ceased. She gradually came to recognize the fact that her polyphagia resulted from emotional stresses rather than from a physical need for food. Within 2 weeks she had become accustomed to the small meals, was encouraged by her weight loss, and the dextro-amphetamine sulfate was discontinued. She continued to lose weight after leaving the hospital.

#### TREATMENT

Many patients are unaware of the threat to life that obesity entails, and they can scarcely be expected to take their condition seriously until they acquire this information. It should be re-emphasized that cardiac and renal disease, glycosuria, and hyperglycemia are urgent indications, rather than contra-indications, for radical weight reduction. If patients with these diseases are obese, weight reduction is often the most effective therapy that can be given. Foremost in the treatment of obesity is caloric restriction. Best results are obtained by definite restrictions. Hunger pangs are no worse on a 400-calorie diet than on a 1,400-calorie diet and the weight loss is much more gratifying. There is generally no danger from such sharp caloric restriction. Obese patients who have subsisted on 450 calories daily were found to remain in nitrogen balance if they got 60 gm. of protein daily.

One of Newburgh's (18) patients was maintained for 1 year on a 300-calory diet. He lost 286 pounds and his health was definitely improved. The patient must be convinced that hunger is a normal healthy sensation and eating should stop short of satiation. He can be assured that if he will stick with the diet for 2 or 3 days the stomach will become accustomed to the lessened intake. The diet offered should be well balanced, high in protein, but extremely low in fat and carbohydrate. Protein has the advantage of its high satiation effect. Meat with all fat removed, fish, shrimp, oysters, skimmed milk, uncreamed cottage cheese, and unsweetened gelatin may be eaten freely. Sugar and butter are restricted and bread is allowed sparingly. Desserts and pastries have no place in the diet of obese persons. Cooked fruit and coffee should be sweetened with saccharin and vegetables flavored with only salt and condiments. A 400. to 600-calory diet is usually preferred. A daily multivitamin capsule is often of value as a means of reassuring the patient that he will not develop a deficiency disease. On such a diet the average patient can be promised a weight loss of 3 to 4 pounds a week. Both patient and physician should be acquainted with water swings in which periods of eliminating water often alternate with periods of retention. Some patients may fail to show weight loss for as long as 2 weeks but this will always give way to a subsequent rapid loss so that the end result will coincide with the estimated loss.

It must be remembered that each patient is an individual problem and the effort should be made to understand and correct the factors which produce obesity. Once the desired weight has been reached, attention should be given to the establishment of dietary habits that will maintain it. It often helps to tell women that continual fluctuation of their weight predisposes to the formation of wrinkles. The patient should visit the physician frequently in the early course of dieting. Otherwise there is a tendency to postpone the dieting until the time for the patient's return visit. Having lost no weight, he is ashamed to return and decides to try some magic cure a neighbor has recommended or go to another physician.

Another approach to female patients is to tell her that she is 130 pounds of her charming self and 100 pounds of inert fat. An obese patient may also be told that for him to be fat is equivalent to carrying a neon sign stating, "I am unhappy." Thyroid extract is indicated in myxedema only. The obese patient is already metabolizing more energy than the normal person just to maintain his corpulent state. To add thyroid extract is like giving it to the thyrotoxic patient who has a basal metabolic rate of plus 50. The increased mortality in these persons is caused by the strain placed on their vital organs by the increased metabolic demands. The object of therapy is to decrease that

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BLOOD VOLUME DETERMINATIONS IN THE UROLOGICAL PATIENT. An Adjunct in Preoperative and Postoperative Management, by Gladen E. Hamilton, Lieutenant Colonel (MC) U. S. A., and Raymond J. Getz, Major (MC) U. S. A. *Journal of Urology* 62: 607-616, Oct 1949.

The blood volume was determined in 40 patients who were poor surgical risks. While these determinations have been employed for several decades by physiologists, only recently a method sufficiently accurate for general employment has been popularized. The Evans blue-dye technique developed mainly by Greger森 has made possible the performance of these determinations in any well-equipped hospital. The method consists of the electrocolorimetric measurement of the intensity of a dye 10 minutes after it is injected intravenously into the patient and comparison with a known standard. Weight loss in these patients was not constantly indicative of the blood-volume deficit. Deficits in 8 patients, who apparently had lost no weight, averaged 30 percent. There was no constant relationship between the blood volume and red blood cell counts, hematocrit, and hemoglobin determinations. The majority of the patients who had adequate replacement therapy recovered uneventfully following operation. In this series the correction of blood-volume deficit by whole blood transfusions was considered to be the most important single factor in the preparation of these patients for operation and their satisfactory postoperative course. The advantage of adequate replacement therapy after blood-volume determination will become more evident in the future by the reduced incidence of operative shock, postoperative wound dehiscence, infection, and poor wound healing.—Abstract



# Parathyroid Adenoma

## Report of Two Cases

DONALD E. REINER, Lieutenant Colonel, MC, U. S. A.<sup>1</sup>  
LEONARD D. HEATON, Brigadier General, MC, U. S. A.<sup>2</sup>

**P**RIMARY hyperparathyroidism is caused by excessive formation of parathyroid hormone. This may in turn be caused by a single adenoma, multiple adenomas, a carcinoma, or idiopathic hyperplasia of the parathyroid glands. In many undiagnosed early cases of hyperparathyroidism, with a few significant symptoms, the diagnosis could have been made if estimates of blood calcium had been made as part of the clinical studies of patients having routine physical examinations (1). Norris (2) has recommended that case reports of all cases of primary hyperparathyroidism be published, with a view to clarifying the unsolved problems connected with this disease.

### CASE REPORTS

**Case 1.**—A 45-year-old soldier entered this hospital on 11 March 1949 complaining of postprandial discomfort, nausea, and vomiting of about 9 years' duration. He was hospitalized at the time of the onset and roentgenographic studies revealed a chronic duodenal ulcer. He was discharged and instructed to take a bland diet for a short time. His symptoms for the next 7 years had been mild. In November 1947 his ulcer recurred. He was transferred to this hospital in January 1948 and was again given a bland diet; and his symptoms were relieved. In October 1948 he had a severe cold and voided some dull red urine. On 20 February 1949 he had anorexia, nausea, and vomiting. He improved on a milk diet and was well until 7 March. At that time he had aching pain in both testes associated with mild tenderness in the right costovertebral angle. Sexual excitement aggravated the testicular pain. The pain in the right costovertebral angle persisted, and was associated with oliguria, but there were no other urinary symptoms. He continued to have nausea and vomiting after eating until the time of admission to this hospital.

Physical examination revealed a blood pressure of 170/100, mild tenderness in the right costovertebral angle, and bilaterally hyperactive reflexes. The leukocyte and differential counts, the hemoglobin, and the erythrocyte count were normal. A roentgenogram of the abdomen revealed an area of calcification overlying the sacrum and right pelvis, and a recheck revealed two small areas of calcification in the region of the lower pole of the left kidney. There was also

<sup>1</sup> Letterman General Hospital, San Francisco, Calif.

an area of calcification, 13 by 03 cm., overlying the right side of the sacrum. A tentative diagnosis of chronic duodenal ulcer and renal calculi was made.

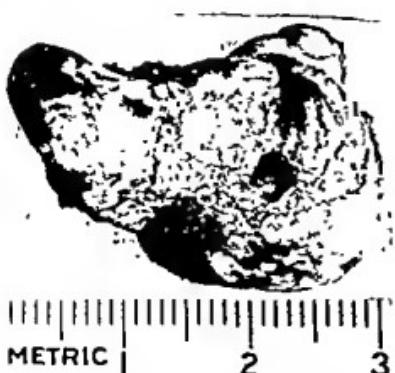
Phenobarbital, 0.1 gm three times a day, tincture of belladonna, and a bland diet was prescribed. The symptoms of gastric retention were promptly controlled. On 22 March intravenous pyelograms revealed small calcifications in the lower poles of both kidneys. Function was good bilaterally with normal-appearing renal pelvis. The calyces were incompletely outlined. In the region of the lower end of the right ureter there was an oval calcification, 12 by 6 mm., that gave the appearance of a ureteral calculus. The serum calcium was 11.7 mg per 100 cc on 15 March, and 14.1 mg per 100 cc on 23 March with a serum phosphorus of 2.8 mg per 100 cc. A diagnosis of parathyroid adenoma was made. The urologist advised the removal of the calculus in the lower third of the right ureter before exploration for the parathyroid adenoma. On 23 March under spinal anesthesia a right ureterolithotomy was performed. The patient's postoperative course was uneventful. He was transferred to the general surgical service on 2 April. His serum calcium remained around 14.1 mg and his serum phosphorus remained around 2.4 mg per 100 cc. His 24-hour urine contained 0.4 gm of calcium and 0.43 gm of phosphorus. A roentgenographic survey of the skeleton revealed no abnormalities. His serum alkaline phosphatase was 0.3 units and his acid phosphatase was 0.18 units.<sup>2</sup>

On 21 April under sodium pentothal, nitrous oxide, and oxygen anesthesia the parathyroid glands were explored. On exploring the right lobe of the thyroid numerous small nodules were noted throughout the gland. The lower pole of the right lobe was explored first in accordance with the view that this is the most common site of a parathyroid adenoma (2). In this region a red-brown mass, about 3 by 1.5 cm, was identified and separated from the lower portion of the right lobe of the thyroid by blunt dissection. It was found to have its own vascular supply and to be entirely separate from the true capsule of the thyroid. The specimen was immediately sent to the laboratory for frozen section. Following this the upper portion of the right lobe, the left lobe and the area between the esophagus and trachea was explored with no evidence of abnormal parathyroid glands. By this time a report had been received from the laboratory that the removed specimen was a parathyroid adenoma. Before closing the wound a specimen of blood was removed from the anterior jugular vein and sent to the laboratory for serum calcium and phosphorus determinations. This revealed the serum calcium to be 11.3 mg per 100 cc and the serum phosphorus to be 3.0 mg per 100 cc. Postoperatively the patient had no signs of parathyroid tetany. His serum calcium gradually fell to 10.3 mg per 100 cc on the fifth postoperative day and the serum phosphorus remained unchanged. He regained his strength rapidly. A roentgenogram on 11 May revealed no change in the renal calculi. The patient was seen in the follow-up clinic on 14 August at which time he stated that he had not felt so well in years. His ulcer symptoms had not returned.

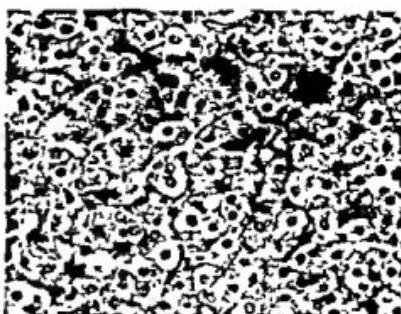
#### *Pathologic findings*

The specimen was a pear-shaped, relatively smooth, reddish mass of tissue, which measured 0.4 by 1.5 by 3 cm and weighed 3.1 gm. It was covered by a membranous capsule (fig 11). The cut surface was homogeneous, compact, and pinkish. Microscopically the specimen was extremely cellular and showed a thin unbroken connective tissue capsule. The cells were arranged in cords and

<sup>2</sup> Shlomo and Jones and Reinhardt method.



*Figure 1.—Case 1. Parathyroid adenoma removed from patient.*



*Figure 2.—Case 1. Microscopic appearance of parathyroid adenoma.*

compact adm supported on a scant connective stroma, and separated occasionally by sinusoidal vascular channels. Generally, the cells presented a broad eosinophilic cytoplasm and a small dark round nucleus (fig. 2). The diagnosis was parathyroid adenoma.

**Case 2**—A 57-year-old housewife entered this hospital on 11 August 1949 with a history of back pain and lower abdominal pain of 1 day's duration. Three years before she had had an attack of right renal colic but no nausea, vomiting, or hematuria. Roentgenograms at that time revealed no evidence of calculi, but there was some evidence of a kink in the ureter. Two years before admission she had had pain in the left flank without nausea, vomiting, or hematuria. On four occasions in the week before admission she passed slightly blood-tinged urine. On the night before admission she had urinary urgency and frequency and distress in the lower midportion of the abdomen but no nausea, vomiting, or hematuria. On the day of admission she complained of lower abdominal distress and lumbar pain bilaterally.

Physical examination revealed a blood pressure of 150/85. There was tenderness in the left flank and pain in the left costovertebral angle. A tentative diagnosis of renal calculus in the left kidney was made. The leukocyte and differential counts were normal. The hemoglobin was 12.8 gm. The urine was essentially negative. On 18 August the serum phosphorus was 2.3 mg per 100 cc. and the serum calcium was 13.2 mg per 100 cc. On 12 August a roentgenogram of the abdomen showed some calcific density in the region of the left kidney. Intravenous pyelograms on 15 August revealed a calcific density in the distal extremity of the left ureter. On 19 August with a ureteral catheter in place, roentgenograms reverted the previously described opacity lying immediately to the side of the catheter in the lower one-third of the ureter.

On 19 August through a cystoscope a calculus was removed from the left ureter with an Ellik loop. A recheck of the serum calcium and phosphorus showed them to be elevated, a diagnosis of parathyroid adenoma was made. On 29 August a classical collar incision was made in the neck and exploration for adenoma of the parathyroid was performed. Exploration of the right lobe was negative. Exploration of the left lobe revealed no elliptical mass, 2.5 by 2 cm., below the lower pole of the thyroid nested in the branches of the inferior thyroid artery. Two small vessels were seen entering the upper pole of the tumor. The red-brown tumor which was slightly darker than the thyroid tissue was removed. Postoperatively the serum calcium fell and the

serum phosphorus slowly returned to normal. The patient promptly regained her strength. At no time was there evidence of tetany. She was discharged on 8 September, at which time she was completely asymptomatic.

#### *Pathologic findings*

The specimen measured 1.7 by 1.2 by 1.1 cm. and weighed 1.9 gm. (fig 3). Microscopic section showed partial encapsulation of cellular stroma within a loosely interwoven network of fibrous tissue elements. The cellular stroma was composed

principally of closely packed cells which were segregated into acinarlike follicular arrangements by the interlacing fibrous tissue elements. The majority of the cells had dark-staining nuclei with relatively abundant cytoplasm. Occasional cells showed deep-staining acidophilic cytoplasm with multiple nuclei. The diagnosis was parathyroid adenoma.



Figure 3—Case 2. Parathyroid adenoma removed from patient

#### DISCUSSION

Black (3) reviewed a series of 63 cases at Mayo Clinic in 1946 and found that the condition was almost equally distributed between the sexes (31 women and 32 men) and the highest age incidence was in the fourth decade. The weight of the adenomas varied from 0.1 to 101 gm., almost 50 percent weighing 2.5 gm. or less. Norris (2) reviewing 322 cases of patients with parathyroid adenoma observed from 1903 to 1915 inclusive, noted the age incidence as being between 14 and 77 years with the maximum incidence between 40 and 50 years of age; in 317 cases there was a sex predominance of women over men in the approximate ratio of 3:1 in single adenomas and 4:1 in multiple adenomas. Of this group he found multiple adenomas in 20 instances or 6.2 percent while a single adenoma existed in 302 cases or 93.8 percent. The location of the tumor was recorded in 251 cases. In 132 cases (52.6 percent) the adenoma occurred on the right side and in 119 cases (47.4 percent) it was found on the left side of the neck. The weight of the adenoma varied from 0.4 to 120 gm. (average 12.7). The adenoma is usually well encapsulated and soft with a smooth surface. Through the capsule the adenomas often appear gray-brown. The cut surface is usually moist, homogeneous, and yellow-brown. Associated clinical findings include osteitis fibrosa and renal lithiasis alone or combined.

The signs and symptoms can best be divided into (a) those caused by hypercalcemia, consisting chiefly of muscle weakness and decreased muscle excitability such as constipation associated with nausea and vomiting, (b) those referable to the urinary tract, and (c) those referable to the skeletal system such as skeletal pain, epilides, and pathologic fracture (4).

Albright and Reifenstein (5) have divided the clinical types of primary hyperparathyroidism into (a) those with bone disease and without kidney disease, (b) those with bone disease and with kidney disease, (c) those without bone disease and with kidney disease, and (d) those without bone disease and without kidney disease. With only the findings of hyperealcemia, hypophosphatemia, hypercalciumuria, and hyperphosphaturia the diagnosis may be established with complete certainty (3). These characteristic findings might, however, be modified in cases of chronic renal disease with retention of metabolites, and retention of phosphorus might occur with consequent depression of the level of calcium in the blood. As the best method of establishing this Black (3) suggested that in surgical exploration for parathyroid adenomas a fairly complete dissection should be performed on the first side explored before crossing the midline. He is opposed to performing an exploration of the anterior superior mediastinum at the time when the cervical and posterior superior mediastinal exploration is performed, if the adenoma is not found in the neck. Instead he recommends performing the anterior superior mediastinal exploration after the cervical incision is well healed and after it can be demonstrated that the patient has not been cured.

The only form of acceptable therapy is complete surgical excision of the tumor. When the parathyroid glands are removed, there then results in this sequence: (a) an immediate decrease in phosphorus excretion in the urine, (b) an increase in serum phosphorus, (c) a fall in serum calcium, and (d) a decrease in calcium excretion in the urine. The patient's electrolyte patterns return to their normal state. If parathyroid extract were given to a normal person a reversal of these metabolic changes would have occurred but in the same sequence. The parathyroid hormone acts on the electrolyte equilibrium of the body fluids and the bone changes, when they occur, are secondary to the chemical changes (5). Finally Cope (6) states:

The cornerstone to successful surgery of the parathyroids is a positive diagnosis. An exploratory operation to confirm or disprove a doubtful diagnosis has little or no place in the field. The findings of the laboratory are more exact than the dissection of the surgeon, and there is no point in the operation, at which the operator may lay down his scalpel and find comfort in having disproved the diagnosis.

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MINIMUM POSTOPERATIVE MAINTENANCE REQUIREMENTS FOR PARENTERAL WATER, SODIUM, POTASSIUM, CHLORIDE, AND GLUCOSE.  
by Robert Elman, M. D.; Richard A. Lemmer, M. D.; Theodore E. Weichselbaum, Ph. D.; James G. Owen, M. D.; and Richard W. Yore, M. D. *Annals of Surgery* 130: 703-722, Oct 1949

Balance studies were carried out in 40 surgical patients on a completely intravenous intake for 26 postoperative hours, and in a few cases during several preoperative days. Study of the urinary output included volume, specific gravity, creatinine, sodium, potassium chloride, phosphate nitrogen, glucose, and acetone. Blood levels of sodium and potassium, chloride  $\text{CO}_2$ , plasma, protein, and red cell volume were also measured before and after each study.

With an intake limited to 2 liters a day there was an adequate urinary output during the 4 postoperative days of about 1 liter except for a moderate oliguria during the first postoperative day. The oliguria was accompanied by a decreased creatinine excretion with no change in specific gravity.

With no electrolyte intake, the body rapidly conserves sodium and chloride, but not potassium and phosphate. The cumulative loss during 4 postoperative days averaged about 4 gm calculated as sodium chloride and 6 gm calculated as potassium chloride. No changes in plasma levels of sodium, potassium,  $\text{CO}_2$ , proteins, or in red cell volume were observed on this intake.

With an intake of 9 gm of sodium chloride a day, there was a definite lag in excretion so that of the 26 gm injected, an average of about 14 gm was retained. The loss of potassium, however, was the same.

It is estimated from these findings that an intake of 2 liters of water plus 2 to 4 gm of a mixture of sodium and potassium chloride (or glucinate) would meet the minimum requirements for these elements in the postoperative patient.

Calculation of the potassium-nitrogen excretion ratio suggests that only part of the potassium loss originated from the break-down of tissue protoplasm.

The nitrogen sparing effect of 200 gm of d glucose was not significantly greater than 100 gm of d glucose. On the other hand, because of an undoubted disturbance in carbohydrate metabolism, acetoneuria was more frequent under the latter than under the former intake. Glycosuria conversely was greater with a 200 gm intake as compared with a 100 gm intake. In order to determine the minimum requirements for d glucose, further observations will be necessary, particularly with regard to the influence of the rate of injection.—Abstract.



# Acute Disseminated Lupus Erythematosus

Report of Three Cases in Young Polish Men

SAMUEL L. MOSCHELLA, Lieutenant, Junior grade, (MC) U. S. N.<sup>1</sup>  
ROBERT L. GILMAN, Captain (MC) U. S. N.<sup>1</sup>

FROM July 1947 to January 1948, three cases of acute disseminated lupus erythematosus were seen at the United States Naval Hospital, Philadelphia, Pa. These young men were of pure Polish extraction and all had type A blood.

A review of the literature showed no definite information concerning racial predilection for this disease. In 1942, Galan (1), reviewing the literature for the geographic distribution of lupus erythematosus, found the incidence of the patients with new cutaneous diseases in the United States to be 0.4 percent and no appreciable difference in any part of the world except in the tropical countries where it is rare among the colored races.

## CASE REPORTS

**Case 1.**—T. L. S (2), a 35-year-old white man of pure Polish descent, had sore throats frequently as a youngster and as an adult. Five months before admission, he had sinusitis and was treated with penicillin irrigations. At this time he noticed a small erythematous macule over the left malar eminence. Three months later, he had a septic-type fever, chills, generalized malaise, abdominal pain, nausea, vomiting, and diarrhea of 8 days' duration. He believed that there was an recentration and spread of the erythematous patch over the left cheek, bridge of the nose, scalp, and ears during this time.

Physical examination on admission showed a well-developed and well-nourished but very sick white man with the following outstanding physical findings: inflammation of the pharynx; a sinus tachycardia; and generalized abdominal tenderness.

The laboratory findings were: Hemoglobin varied from 11.5 to 12.5 gm.; red blood cell count varied from 3.9 to 4.5 million; and white blood cell count varied from 5,050 to 11,200 with a slight shift to the left, type A blood; blood Kahn test and all blood cultures were negative; urine concentrated to 1015, with a slight

<sup>1</sup> U. S. Naval Hospital, Philadelphia, Pa.

trace of albumin, no occasional red blood cell, and 2 to 3 white blood cells in the sediment; blood urea nitrogen, 165 mg per 100 cc. blood; chest roentgenogram was negative; sputum, negative for tubercle bacilli; electrocardiogram showed ST segment and T-wave changes in all leads as well as right axis deviation and the graph was consistent with acute pericarditis.

Treatment consisted of sulfadiazine 10 gm daily in divided doses, parenteral fluids, transfusions, large doses of ascorbic acid, 50 mg of pyribenzamine every 4 to 6 hours by mouth, digitalis, oxygen, and sedation.

His temperature hovered about 105° F. pulse, 140 respirations, 40, and blood pressure, 120/85. Three days after admission the skin lesions were less erythematous but new lesions appeared on the buttocks. He became progressively more stuporous and dyspneic. With the onset of clinical evidence of cardiac failure, digitalis was administered. Respirations became more labored and he died 8 days after admission. Terminaly, all his lesions became purple.

*Necropsy report*.—Atypical verrucous endocarditis, myocardial fibrosis, bronchopneumonia, connective tissue degeneration around blood vessels, and wire looping of the glomerular capillaries.

*Case 2*.—A. J. L., a 25-year-old white man of pure Polish descent, had had frequent attacks of urticaria precipitated by the ingestion of citrus fruits and tomatoes. At the age of 18, he had a reaction to tetanus antitoxin, manifested by partial collapse and urticaria. For the last 2 years his wife had noticed that he had a malar flush whenever he drank alcoholic beverages or became excited.

He was first admitted to the hospital in August 1947 because of fever and multiple joint pains. Physical examination showed an inflamed throat and several swollen phalangeal joints. Eight days after admission an abscessed tooth was removed, no change occurred in his clinical picture. Electrocardiogram was negative, blood sedimentation rates were elevated, hemoglobin, white blood cell count differential count and urinalysis were negative, roentgenograms of the small bones of the hands showed changes consistent with early rheumatoid arthritis. He was hospitalized for 27 days at this time and was discharged with instructions to receive from his physician a course of treatment with proprietary streptococcal vaccine for his arthritis.

During his 24 days at home he continued to have generalized arthralgia and fever. Two weeks before the second admission he noted an erythematous eruption on the malar areas. A week before the second admission he was told he had a similar eruption at the base of his spine. During this week while he was treated with the vaccine, he had a sore throat, chills, anorexia, nausea, and diarrhea.

The second-admission physical examination showed a very sick patient with a follicular pharyngitis, grade 2 aortic systolic murmur, slugs tachycardia, blood pressure of 112/64, and a few moist inspiratory rales at the bases. The remainder of the examination was not remarkable.

The laboratory findings were hemoglobin, from 11 to 12 gm.; red blood cell count varied from 3.2 to 4.3 million; white blood cell count varied from 4,700 to 7,800 with a shift to the left, normal platelet count, coagulation, and bleeding time, type A blood. Kahn test and blood cultures were negative. Hemolytic streptococcus was cultured from the pharyngeal ulcer. Urine showed a slight trace of albumin, 2 to 6 red blood cells, and 2 to 10 white blood cells; it concentrated from 1,010 to 1,015, blood urea nitrogen, 14 mg per 100 cc., admission roentgenogram was negative, but final examination showed bilateral pleural effu-

sion; electrocardiogram showed low voltage and diphasic QRS waves in lead 1 and 3; a biopsy of skin from the face showed changes consistent with acute disseminated lupus erythematosus.

He was treated with 100,000 units of penicillin intramuscularly every 3 hours, large doses of vitamin C parenterally, 50 mg. pyribenzamine by mouth every 6 hours, frequent blood transfusions, parenteral fluids, digitalis, oxygen, sedation, and cautery of the pharyngeal ulcer.

During this course temperature varied from 99° to 105° F.; pulse from 80 to 130; and respirations from 20 to 40 per minute. After 3 days of hospitalization he appeared to improve, but the right tonsillar ulcer was not improved. Six days after admission, there was an extension of the skin eruption to the lower anterior chest, thighs, and feet, while the face lesions were less erythematous. Eight days after admission he had a gallop rhythm and evidence of bilateral pulmonary edema. Digitalis was administered but the patient continued to be dyspneic and to fail. He died 17 days after admission.

At necropsy, there was hypertrophy, dilation, and fibrosis of the heart, atelectasis of both lungs, bilateral pleural effusion, hyalinization and thickening of the arterioles of the spleen, cirrhosis of the liver, and thickening of the capillary loops of the kidney.

**Case 3.**—F. C. Z., a 20-year-old white man of pure Polish extraction, had eczema as a child, and had diarrhea whenever he drank milk or ate tomatoes. He had recurrent hay fever since the age of 12. One year before his first admission he had an attack of lues, cause unknown.

He was hospitalized with pleurisy for 3 weeks in December 1946. During this time he was treated with one of the sulfonamides. Because of a persistent, generalized, nontender lymphadenopathy, he was sent to a naval hospital for medical observation. Heterophil agglutinations, chest roentgenograms, white blood cell counts, urinalyses, and an electrocardiogram were negative. Two lymph node biopsies showed only hyperplasia. During his stay, he had recurrent episodes of low grade fever and migratory painful joint swellings. All the blood cultures were negative. He was again treated with one of the sulfonamides as well as penicillin, with no change in the clinical picture. After 3 months of hospitalization he became afebrile, relatively asymptomatic, and was given a trial of duty. Following his discharge from the hospital, he had fatigue, anorexia, arthralgia, and a 20-pound weight loss. However, he noted some decrease in the size of lymph nodes.

Four months later he was readmitted because of tender swelling of his right knee for 1 month's duration. He had felt feverish during this attack. He denied any preceding sore throat, conjunctivitis, or urethral discharge. Physical examination showed sinus tachycardia; slight cardiac enlargement with a grade 2 mitral systolic murmur; blood pressure was 140/90; a tender swollen right knee; and generalized nontender lymphadenopathy. The clinical diagnoses considered were acute rheumatic fever or periarteritis nodosa. Electrocardiograms and anti-streptolysin titer were not informative. Lymph node biopsy again showed hyperplasia. Twenty-eight days after his admission an erythematous eruption appeared on the malar areas, across the bridge of his nose, on his ears, and in his scalp. A specimen of the involved skin was taken for biopsy and changes consistent with acute disseminated lupus erythematosus were reported. He had hemorrhage into the left fundus and phthisis of the left eyelid. He continued to have a low grade fever. The facial eruption became less erythematous but more pigmented. He was sent home for convalescence but was readmitted in 6 weeks. Upon his return, he was given several blood transfusions,

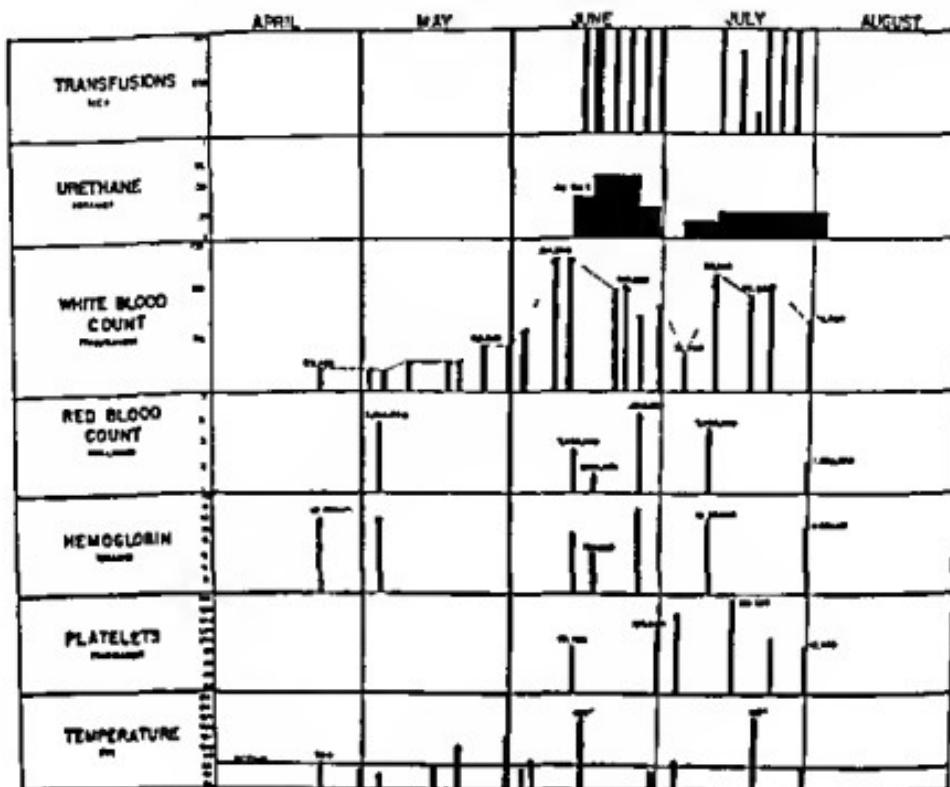


Figure 1—Hospital course.

no avail, and the patient died on 9 August 1949. Autopsy performed at the Veterans' Hospital, Illinois, Ill., revealed widespread leukemic infiltration and terminal multiple spontaneous hemorrhages. Figure 1 graphically illustrates the hospital course.

#### COMMENT

The sequence of events led to speculation but no conclusion. This patient was one of three typical cases of infectious mononucleosis in this hospital at the time. The clinical course of the other two was uneventful. Of further interest is the work of Weinstein and Fitz-Hugh (4) indicating that an increase in the heterophile agglutination titer does not occur in leukemia.

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# Preservation of Neurotropic Viruses

PETER K. OLITSKY, M.D.<sup>1</sup>

ROBERT H. YAGER, Lieutenant Colonel, V.C., U.S.A.<sup>1</sup>

LESLIE C. MURPHY, Major, V.C., U.S.A.<sup>1</sup>

THE advantages of 0.2 percent bovine serum albumin in buffered saline solution over animal serum, as a diluent for influenza and yellow fever viruses in infectivity titrations, were described by Dick and Taylor (1). The chief advantages are (*a*) ease of preparation of the albumin solution; (*b*) its lack of specific or nonspecific virus inactivating substances (2) (3), (*c*) its ready sterilization; and (*d*) the clearness of the solution. This laboratory later found that serum albumin solution was a satisfactory diluent for a large number of neurotropic viruses in experiments on hemagglutination because it offered a nonagglutinating medium and no loss of titer of the virus was noted in the time taken to perform the test (4). The viruses employed were: Columbia SK, Columbia MM, and Mengo encephalomyelitis; encephalomyocarditis; Eastern, Western, and Venezuelan equine encephalitis; Japanese, St. Louis, and Russian Far East encephalitis; vesicular stomatitis (New Jersey and Indiana strains); West Nile disease; rabies; lymphocytic choriomeningitis; louping ill; herpes simplex; Theiler's disease (F. A., T. O., and GD-VII strains); and poliomyelitis (Lansing and MEF1 strains). In a single preliminary test with Eastern equine encephalitis virus, it was found that virus recovered from the brain and diluted in 10 percent normal rabbit serum had an LD<sub>50</sub> titer of 10<sup>5.5</sup> while the same virus diluted in 0.2 percent albumin solution yielded an LD<sub>50</sub> titer of 10<sup>9.2</sup>.

It was desired to find out whether the albumin solution could replace animal serum for the preservation of neurotropic viruses for long periods of time and whether viruses in such solutions could be maintained in a mechanical refrigerator at -20° to -25° C. at sufficiently high titers (5). It has already been shown that electrically operated, mechanical refrigerators held at -20° to -25° C. have certain advantages over dry ice for prolonged preservation of certain viruses in serum suspensions. The object of this article is to describe tests on the maintenance of neurotropic viruses in the albumin solution stored

<sup>1</sup>The Laboratories of the Rockefeller Institute for Medical Research.

in a frozen state in a mechanical refrigerator for varying periods of time up to 1 year.

#### METHOD

Crystallized bovine plasma albumin was prepared by following the directions given by Dick and Taylor (1). For storing viruses in the frozen state a 2 percent albumin solution was used; and for their dilution, as in infectivity titrations, 0.2 percent was used. The refrigerator was of the type used by Olitsky et al (5). It was accidentally disconnected 5 months after the beginning of the test and on another occasion, 2 months later, failed to operate properly. As a consequence, the specimens were thawed twice for periods of time varying from a few hours to less than 36 hours. The viruses studied were those of Western equine encephalitis (Rockefeller Institute strain), St. Louis encephalitis (B-33 strain), lymphocytic choriomeningitis, and poliomyelitis (MEF1 strain). The neurotropic viruses were preserved in fresh, infected mouse brains made up as a 1:5 dilution in 2 percent albumin solution. Part of this was used for an initial infectivity titration. A number of the remaining specimens were placed in screw-capped nitrocellulose tubes and stored in the refrigerator which was held at -20° to -25° C. At 3-, 6-, 9-, and 12-month intervals each frozen suspension was thawed rapidly and an infectivity titration by the intracerebral route, in serial decimal dilutions, was made. The Swiss-W strain of mice was used for the titrations of the St. Louis encephalitis virus and the Rockefeller Institute strain was used for the others.

#### RESULTS

The results of the tests (table 1) revealed that stability varies with the virus employed. After storage the MEF1 virus retained its initial LD<sub>50</sub> titer at least for the entire year. The other viruses studied were not so stable. The infectivity of Western equine encephalitis virus held up well for 9 months but after 12 months exhibited a drop of almost 3 logarithmic units from its initial titer. St. Louis encephalitis virus retained its LD<sub>50</sub> titer during 3-month storage but

TABLE 1.—Effect of storage of 1:5 virus suspensions in 2 percent albumin solution on infectivity titer

Virus and original LD <sub>50</sub> titer	LD <sub>50</sub> titer after storage			
	3 months	6 months	9 months	12 months
Lymphocytic choriomeningitis 10 <sup>-4.5</sup>	10 <sup>-4.5</sup>	10 <sup>-4.5</sup>	< 10 <sup>-4.5</sup>	—
Lymphocytic choriomeningitis 10 <sup>-4.5</sup>	10 <sup>-4.5</sup>	10 <sup>-4.5</sup>	10 <sup>-4.5</sup>	—
Western equine encephalitis 10 <sup>-3.5</sup>	10 <sup>-3.5</sup>	10 <sup>-4.5</sup>	10 <sup>-5.5</sup>	10 <sup>-6.5</sup>
St. Louis encephalitis 10 <sup>-3.5</sup>	10 <sup>-3.5</sup>	10 <sup>-4.5</sup>	10 <sup>-5.5</sup>	10 <sup>-5.5</sup>
Poliomyelitis (MEF1) 10 <sup>-4.5</sup>	10 <sup>-4.5</sup>	10 <sup>-4.5</sup>	10 <sup>-4.5</sup>	10 <sup>-4.5</sup>

was reduced about 2 logarithmic units after 6 months and was still infective after 1 year. The infectivity of the virus of lymphocytic choriomeningitis, however, fell off at 3 months and was greatly reduced after 6 months.

#### SUMMARY

The level of infectivity titer exhibited during prolonged storage in a frozen state at  $-20^{\circ}$  to  $-25^{\circ}$  C., and suspended in 2-percent bovine plasma albumin in buffered saline solution, varies with different viruses. The poliomyelitis MEF1 virus retained its original titer throughout a year while lymphocytic choriomeningitis virus showed a decrease at 3 months, the St. Louis encephalitis virus at 6 months, and the Western equine encephalitis virus at 12 months. The effect of two accidental thawings on the titer is unknown and it is not known what the results might have been if dry ice had been used instead of a mechanical refrigerator. All the viruses could be recovered by animal passage after storage for 6 to 12 months. Olitsky et al., using an adequate amount of normal rabbit serum instead of albumin solution for the preservation of certain neurotropic viruses in a mechanical refrigerator, recorded a definite reduction in titer of some of them at 3 and 9 months (5). The method here described for preserving viruses is applicable to conditions in which a buffered saline solution of bovine plasma albumin is desired as a substitute for animal serum, preserved in a refrigerator. The variations in the preservation of the viruses here studied would indicate that a pattern of infectivity after storage must first be determined for each virus before the method is generally adopted.

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wrinkled. He shivered intensely and kept curled up as tightly as possible. Examination of the lungs revealed no abnormally although auscultation was difficult because of the muscular tremor. There was difficulty in determining the size of the heart and a cardiac impulse could not be felt. The sounds were indistinct and the rhythm absolutely irregular with an average rate of 68. No murmurs were heard. The blood pressure was 100 mm Hg systolic and 60 diastolic. An electrocardiogram (fig 1) showed auricular fibrillation with the ventricular rate averaging about 75 a minute. The baseline was irregular, due to body tremor. The S-T junction was slightly elevated in lead 1 and the T waves were nearly isoelectric in this lead but upright in leads 2 and 3.

The patient after being given an ounce of alcohol hot coffee, and ephedrine (72 mg intramuscularly) was gradually warmed under blankets. He responded quickly to therapy and 8 hours after admission he was ambulant. He rested the following day, then returned to work.

Eighteen days later he was asked to return for reexamination. He appeared to be 10 years younger than he did on the first admission and stated that he felt well. The heart was not enlarged and the apical thrust was easily palpable. The sounds were distinct, of good quality and no murmur were heard. The rhythm was normal at a rate of about 72. The blood pressure was 110 mm Hg systolic and 64 diastolic. The remainder of the examination revealed no abnormalities. An electrocardiogram taken at this time (fig 2) showed normal rhythm at a rate averaging about 65. The T waves were now tall and upright in lead 1.

### DISCUSSION

The general features of this case illustrate the fact that persons who are not far from death as the result of hypothermia may be quickly restored to their previous state of health. In this regard, cold is almost unique among injurious agents and the explanation is largely to be found in the lowered metabolic activity of the body cells.

The effects of cold on the heart which were observed in our case were diminution in intensity of the heart sounds, feeble heart action, auricular fibrillation with slow ventricular rate, and lowering of the T-wave changes in the electrocardiogram may occur as the result of cooling the heart locally (5) (6) or of generalized hypothermia (7). Clinical studies suggest (8) and pathological studies show (7) that these T-wave changes may occur in the absence of structural damage to the myocardium.

With regard to the auricular fibrillation, two features are worthy of special notice, namely, the slow ventricular rate and the spontaneous return to normal rhythm. The former implies a considerable degree of auriculoventricular block which is probably caused by the direct effect of cold on the heart. The possibility of vagus overactivity must be considered but Tomaszewski (9) has shown that in animals, at least, slowing of the heart as the result of hypothermia may be independent of vagal activity. The spontaneous return to normal rhythm is characteristic in these cases.

The appearance of auricular fibrillation under conditions of hypothermia has not been satisfactorily explained. Vagus overactivity and alteration in the chemical and endocrine constituents of the blood have been mentioned as possibilities. However, there is no proof that any of these are important etiologic factors. One possibility that has not received attention is that, in contrast to many other organs, the heart must do considerable work regardless of how low the body temperature falls if the person is to survive. However, a point must be reached when the metabolism of heart-muscle cells is sufficiently reduced or otherwise interfered with so that contractility is faulty. This amounts to a local cause for failure and offers a reasonable explanation for the appearance of fibrillation in the auricles.

#### SUMMARY

A previously healthy young man nearly perished from hypothermia as the result of accidental immersion in cold water. Auricular fibrillation was among the clinical findings.

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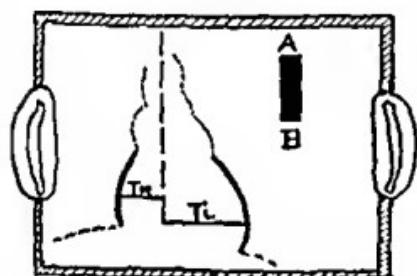
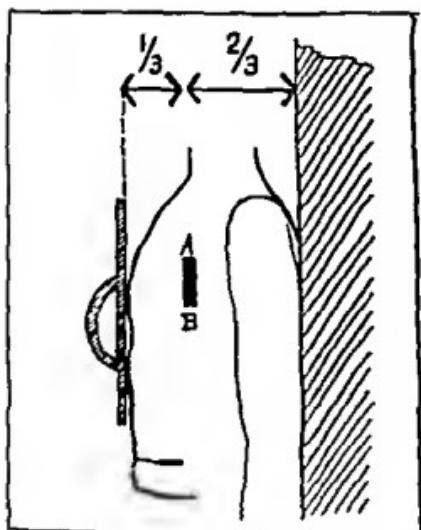
# Orthodiascopic Measurements During Fluoroscopy

## A Device

ALLEN S. JOHNSON, Commander (MC) U. S. N. R.

**A**VARIETY of procedures have been devised for the roentgenographic estimation of heart size but most of these have certain drawbacks which are well considered in various texts on cardiology such as the third edition of White's "Heart Disease." Even in teleoroentgenograms there is a distortion from divergent rays amounting to 5 to 8 percent depending on the tube-film and object-film distance. As a consequence the tables and nomograms for the prediction of normal teleoroentgenographic values differ from those for orthodiascopic reference. Furthermore the wide range of the normal heart size and shape in correlation with height, weight, and body surface area, makes the rigid application of so-called normal standards to borderline cases extremely hazardous. However, there is some merit in any simple procedure which introduces a quantitative element into clinical evaluations provided it is not slavishly followed.

The device described permits correction for the distortion of the ordinary vertical fluoroscopic image so that the actual transverse diameter of the heart may be recorded for comparison with tables of orthodiascopic normals or with subsequent observations on the same patient. It is a modification of Gubner and Ungerleider's method (1) for measuring heart size in miniature films and any credit for originality is entirely theirs. This modification eliminates the markings on the lead scale which are hard to read on the fluoroscopic screen and does away with the bracket for the support of the lead scale. It also avoids disturbing the screen-tube relationship when the patient, in the original method, steps aside to permit projection of the scale on the screen. Both methods are based on the assumption that a radio-paque body in the same plane as the heart will be enlarged on the fluoroscopic screen to the same extent as the heart shadow. The heart plane is usually one-third of the distance from the front to the



$$\frac{T_R + T_L}{X} = \frac{AB}{50\text{mm}}$$

Figure 1.

this diagram, along with the image of the lead standard of reference, transferred to tracing paper for future comparison. It is important that the ribbon be attached to the chest in a vertical plane as obliquity will introduce serious distortion.

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# Continuous Spinal Anesthesia: The Ureteral Catheter (Tuohy) Technique

FRANK J. TOINETTA, Lieutenant, junior grade (MC) U.S.N.R.<sup>1</sup>  
WHITNEY WOODRUFF, Lieutenant, junior grade (MC) U.S.N.R.<sup>1</sup>

**I**N 1939, Leinmon (1) described the first method for administering continuous (fractional) spinal anesthesia. He used an indwelling malleable needle in the subarachnoid space. In 1944 Tuohy (2) (3) (4) reported a second method in which a ureteral catheter was threaded into the subarachnoid space through a large gage spinal needle, this needle being immediately withdrawn. The primary objective of the Tuohy method was to overcome technical difficulties of the former technique such as: (a) relative ease of dislodgement of the malleable needle; (b) trauma to the tissues incident to leaving the needle in place; (c) remote hazard of breaking the needle in the tissues, and (d) need for a special mattress. Since the malleable needle technique has been evaluated by many investigators (5) (6) (7) (8) (9) (10) (11) (12) (13) (14), it was decided to study the catheter technique used at the United States Naval Hospital, Philadelphia, Pa., during 1947 and 1948. This article is a review of over 250 cases in which the ureteral catheter method was used for surgical anesthesia and also for several diagnostic and therapeutic procedures.

## TECHNIQUE

**Method.**—The patient is placed in the lateral recumbent position for the lumbar puncture. The skin is cleaned with ether and tincture of iodoform. After draping, a 1 percent procaine skin wheal is made over the lumbar interspace to be entered (usually the third, occasionally the fourth, and, rarely, the second.) Following infiltration of the interspinous ligament with 1 percent procaine, a 16-gage, 3½-inch Huber-point needle is introduced into the subarachnoid space. The needle is directed cephalad so that it makes an angle of approximately

<sup>1</sup> U.S. Naval Hospital, Philadelphia, Pa.

45° with the patient's back. As soon as clear flow of spinal fluid is obtained a graduated 3.5 Fr. ureteral catheter containing a wire stylet is threaded through the needle until it reaches the Huber point (care being taken not to lose an excessive amount of spinal fluid during this maneuver). The wire stylet is then slowly withdrawn as the catheter is simultaneously advanced beyond the point of the needle into the subarachnoid space for a distance of 4 to 5 cm. The stylet is then entirely removed, and the spinal needle withdrawn, leaving the catheter in place. If the catheter is properly introduced into the subarachnoid space, spinal fluid will drip freely from it. If, however, spinal fluid cannot be aspirated easily, the catheter is removed and reinserted because it is believed that the few failures early in the series were due to placing the catheter in the epidural space. When a pares-thesia is noted on inserting the catheter and when it cannot be over-come by slight turn of the needle, the catheter and needle are with-drawn and reintroduced. On occasion the catheter cannot be passed beyond the end of the needle, apparently because of obstruction by the vertebral body when the needle is too far into the canal. This difficulty is encountered more frequently when the needle is perpendicular to the back rather than when in a somewhat cephalad direction. The cathe-ter, once it has been threaded beyond the point of the needle, must not be withdrawn, otherwise the Huber point may be sheared off within the subarachnoid space. When the catheter is satisfactorily in place it is connected to a 10 cc. Luer-Lok syringe and stopcock by means of a Borst adapter, and then fixed to the patient's back with adhesive tape. A small gauze pad is placed at the point where the catheter enters the skin to prevent kinking. The patient is then put into the desired posi-tion for injection of the anesthetic solution.

#### DRUGS

(a) *Preoperative medication*.—Most patients in the series receive pentobarbital sodium (0.1 gm.) the night before and the morning of the operation. Morphine sulfate and scopolamine (or atropine sul-fate) in a 25:1 ratio are given routinely 1 hour before operation.

(b) *Pressor agents*.—Ephedrine sulfate (25 to 50 mg.) is given intra-muscularly as a prophylactic measure 2 to 5 minutes before the initial injection of the anesthetic agent. If subsequent vasopressor activity is required ephedrine, neosynephrin, or desoxyephedrine is given intravenously.

(c) *Anesthetic agents*.—For the surgical cases 4 cc. of 1 percent pon-to-caine hydrochloride are diluted with 6 cc. of 10 percent dextrose so that each cubic centimeter of the mixture contains 4 mg. of pono-caine. The initial dose is from 4 to 16 mg. (average 12 mg.) depend-ing on the physical state of the patient and the operation proposed.

patient and to minimize disturbance to the surgeon due to retching and straining by the patient. Table 3 shows a review of the cases according to the supplemental agents used. Some 20 percent were sufficiently quiet following the preoperative medication to require no further hypnosis. Fifty-two percent received intravenous injections of morphine sulfate and scopolamine (25:1 ratio). It was found that these agents were most effective when given a few minutes before excessive abdominal traction was made. Pentothal sodium was given either in 0.5 percent solution by slow drip or in 2.5 percent concentration by small divided doses. A combination of pentothal-nitrous oxide-curare was given in 2 cases where subsequent doses of spinal anesthesia were impossible because of a kink in the catheter, and in 3 cases where the anesthesia failed because the catheter did not enter the subarachnoid space. Cyclopropane was used in 6 percent. Whenever, during the course of the operation, there was severe hemorrhage (4 cases) or shock (1 case) further use of spinal anesthesia was deferred and the operation was completed under cyclopropane-curare. Cyclopropane in small amounts was found to be the agent of choice in controlling hiccups during gastric surgery.

TABLE 3.—*Supplemental anesthesia*

Agent	Indication	Number of cases	Percent
Morphine sulfate and scopolamine	Sedation and hypnosis	124	42
Pentothal sodium	Excessive restlessness	21	9
	Augment effects of morphine	14	6
	Surgical anesthesia with nitrous oxide and curare	5	2
Nitrous oxide	Analgous and hypnosis	11	5
	Surgical shock	1	2
Cyclopropane	Hiccups	1	1
	Incomplete spinal	1	1
	Hypnosis	5	2
None		51	29
		250	100

### COMPLICATIONS

Postspinal headache which occurred in 41 cases (16 percent) was the most common complication observed in this series. Our criteria for a postspinal headache were as follows. A headache coming on after spinal anesthesia, different in character from any headaches that the patient might have had previously, which was aggravated in the upright position and relieved in the recumbent position. In 31, the

headache was of less than 5 days duration and in 10 it lasted up to 12 days. The average for the group was 4.7 days. Although it was difficult to evaluate the severity of the headache, 9 were classified as mild, 23 as moderate, and 7 severe. In 2 with most severe headache there was associated meningismus but smear and culture of the spinal fluid failed to reveal any organisms. The fluid did, however, appear xanthochromic.

An attempt was made to determine if any relationship existed between postspinal headache, type of operation, and age of the patient. As table 4 indicates, there was no correlation between type of operation (upper or lower abdominal) and the occurrence of headache (columns 3 and 4). However, it was noted that the younger patients

TABLE 4.—*Headache following continuous spinal anesthesia*

Operation	Number having headache	Percent of Total	This operation percent all operations	Average age for operation	Average age with headache
Gastrectomy . . . . .	15	35	32	47	40
Cholecystectomy . . . . .	9	22	15	43	34
Small bowel surgery . . . . .	5	12	8	47	39
Large bowel surgery . . . . .	1	2.5	15	45	33
Exploratory laparotomy . . . . .	4	10	8	48	36
Other operations . . . . .	7	18.5	22	46	46
Total . . . . .	41	100	100	46	40

were prone to develop spinal headaches. The age mode for the series was 51 to 55 years, but the age mode for patients with spinal headache was 35 to 40 years. Furthermore, the average age of a patient having a particular operation was higher than the average age of the patient having that operation and developing a spinal headache (columns 5 and 6 of table 4). In the group that had multiple continuous spinal anesthetics one patient developed headaches following both and one patient had a headache after the first but not after the second operation.

In our series there were no deaths resulting from anesthesia alone.

In the present series where supplemental anesthesia was used freely, the incidence of pulmonary complications appeared to be the same as in the series of Lemmon and Paschal (6) in which no supplemental agents were used.

One patient had total spinal anesthesia following the initial dose (10 mg.). Respiration ceased but she reacted after 45 minutes of artificial respiration during which time her blood pressure and pulse remained normal; the operation was continued. Upon discharge from the hospital she had no apparent ill effects.

Two patients had backache at the site of lumbar puncture not related to trauma during anesthesia. This condition cleared up with-

in a period of 3 months. In no instance did local infection develop at the site of the catheter.

There were two cases of transient residual paresthesia and muscle weakness. In both there was extreme paresthesia at the time of insertion of the catheter through the needle so that the needle was withdrawn and reintroduced at a different interspace. One of these had persistent muscle weakness for about 4 months. The other continued to have hypesthesia and muscle weakness 3 months after the operation, but showed definite improvement with physiotherapy.

#### FOLLOW-UP

One hundred and seventy-five patients in this series were seen from 2 to 18 months following operation. Of these, 26 have died as a result of primary disease (mostly carcinoma) and 5 of other causes. The remaining patients were well and had no complaints referable to the anesthesia except the patient previously mentioned.

#### DISCUSSION

The ureteral catheter (Tuohy) technique of administering continuous spinal anesthesia has proved to be a simple, inexpensive method with certain advantages. First, the catheter can be introduced with the patient on a carrier or bed. This makes the method adaptable to many diagnostic and therapeutic measures. Second, the catheter is introduced far enough into the subarachnoid space to insure that it will not be dislodged by movement of the patient. This permits more freedom in handling the patient and gives more certainty of satisfactory anesthesia with subsequent doses.

There are some theoretical disadvantages to the method. First, it is possible to introduce the catheter into the epidural space and obtain inadequate anesthesia. This can be easily recognized by the failure of spinal fluid to drip from the catheter, and can be remedied by reinsertion. Second, the catheter can kink as the patient lies on it, but this is rare if sufficient care is taken to tape it in place properly. Third, the catheter may be sheared off. To our knowledge no such incident has been reported. Fourth, there is an ever-present danger of local infection, but we have seen no evidence of this even in a case where the catheter was in place for 72 hours. Lastly, there is a high incidence of transient paresthesia at the time of insertion of the catheter but there has not been a correspondingly high incidence of residual paresthesia.

The use of light supplemental anesthesia was found to enhance the patient's comfort, and by its inhibition of reflex nerve-impulses makes for smoother operating conditions.

Residual transient paresthesias were encountered in two cases. This has also been reported following the use of the malleable needle by Apgar (12) and Hale and Shaar (14).

The incidence of postspinal headache was 16 percent in this series. Hale and Shaar (14) using the malleable needle technique at this hospital in 1940 to 1943 encountered this complication in 11 percent of their cases. The incidence of headache following "single dose spinal" in this hospital has been 9 percent. Moreover the incidence has been reported as less than 2.5 percent following the use of the malleable needle by Lemmon and Paschel (6) (11), Apgar (12), and Ausbro and Pico (10). On the other hand Cann and Wycoff (18) using a slight modification of the catheter technique reported headache in 30 percent. It would appear that the incidence of spinal headache following the use of the catheter is higher than with the malleable needle or with the conventional spinal needle. If one of the factors causing spinal headache is the leakage of spinal fluid through the hole in the dura, it would seem that the large hole made by the 16-gage needle would leak more fluid than either of the others which are smaller. Another factor in this higher incidence may be the vigorous early ambulation of recent years which would account for the manifest headaches during the first few days following operation.

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the bladder caused by lower urinary tract obstruction and are more properly designated vesico-umbilical fistulas.

*Incidence.*—Cross (3), in 1935 collected only 96 cases of cysts from the literature. A true patent urachus, congenital or acquired, had been found only in 3 instances in 15,000 admissions to the Brady Urological Institute. Other urachal abnormalities are more rare. The reported incidence of urachal anomalies is subject to question in many instances because of the improper diagnosis of vesico-umbilical fistulas. Herbst (4) found only 148 recorded cases of patent urachus. In 200,000 admissions to the Childrens and Infants Hospital, Boston, Mass., there were 3 cases of patent urachus (5). Campbell reported 15 such cases in 12,000 autopsies on children. The ratio of men to women with this condition is 2.1 (6).

*Pathology.*—There are four principal types of urachal anomalies: (a) complete (patent throughout from bladder to umbilicus); (b) blind external (patent at the umbilical end only); (c) blind internal (patent at vesical end only); and (d) blind end (cyst, the most common type).

Dudgeon (6) listed 8 types of urachal pathology: (a) exstrophy of the bladder; (b) patent urachus; (c) patent urachus and omphalomesenteric duct (4 cases); (d) malignancy (45 cases of mucinous carcinoma (7)); (e) cysts which may weigh as much as 100 pounds; (f) abscess (most common); (g) calculus (4 cases); and (h) tuberculosis (1 case). Pesqueira and Engelking (8) reported 1 instance of actinomycosis.

*Symptoms*, causing a patient to present himself for treatment are almost uniformly those associated with infection. Lower abdominal pain and tenderness are the most common complaints. A suprapubic mass with or without drainage from the umbilicus is frequently present. Gastrointestinal symptoms may predominate suggesting that peritoneal involvement has occurred and that perforation into the peritoneal cavity is imminent (9). Dysuria and pyuria suggest bladder communication.

The *diagnosis* of urachal disease is not easy. The more important conditions to consider in differential diagnosis are: (a) appendiceal abscess; (b) ascites; (c) ovarian cyst; (d) distended bladder; (e) pregnancy; (f) diverticulitis; and (g) patent omphalomesenteric duct (10). The diagnosis is established by cystoscopy, cystography, and radiographic demonstration of a tract by injection through an umbilical opening. Roentgenograms to determine the presence or absence of abnormal soft tissue shadows, and the absence of a tract extending intraperitoneally, may assist in definite differentiation (11) (12).

The *treatment* of urachal anomalies is always surgical. The infected cyst should be incised, drained, and excised later (13). Pri-

mary excision is the procedure of choice for large uninfected cysts, malignancy, tuberculosis, and draining urachal fistulas. The added protection of sulfonamides and antibiotics may permit a more radical primary approach than was possible in the past.

#### CASE REPORT

A 30-year-old officer was admitted to this hospital on 25 December 1948 complaining of fever, mucopurulent drainage from the umbilicus of 4 weeks' duration, and pain and swelling of the lower abdomen of 3 weeks' duration. At the age of 13 years he had frequency of urination and periumbilical pain which subsided without treatment. During the current episode umbilical irrigations with penicillin were given at an Air Force station hospital. These gave temporary relief. With the onset of pain he was given penicillin in oil with no improvement. At no time were there symptoms of bladder irritation.

On admission his temperature was 101° F. The leukocyte count was 10,300 per cu. mm. The urine was normal. The abdomen was moderately distended, voluntary rigidity with severe periumbilical and infranumbilical tenderness was present. There was a moderate amount of foul-smelling purulent discharge from the umbilicus and a probe could be inserted 3 cm. caudad through the small umbilical opening. Four centimeters below the umbilicus there was a tender mass about 5 cm long but with ill-defined lateral margins. Nonhemolytic *Staphylococcus albus* and *Streptococcus* were cultured from the umbilical sinus. A tentative diagnosis of an infected urachal remnant of the blind external type, or of an omphalomesenteric duct was made.

Intravenous pyelograms were normal. Cystoscopic examination revealed no evidence of a urachal opening. Injection of the umbilical tract with a contrast medium showed a narrow tract extending distally in the midline of the abdominal wall for a distance of 3 cm ending in a sacule 2.5 cm in diameter.

Three days following admission the infranumbilical mass was explored. The peritoneal cavity was entered through a right paramedian incision. For a distance of 1 cm. on either side of the midline the peritoneum and omentum were densely adherent to the anterior abdominal wall. The inflammatory mass was continuous with the bladder wall but did not enter the vesical cavity. The mass was removed by sharp dissection including the involved peritoneum, omentum, and umbilicus. Drains were placed in the prevesical space. Closure of the posterior rectus abdominis sheath and transversalis fascia was accomplished with difficulty because about 2.5 cm. of the peritoneum and adjacent structures had been excised. The postoperative diagnosis was abscess of a patent urachus. This was confirmed by pathologic examination.

Both penicillin and streptomycin were administered postoperatively. The course was smooth until the fifth day when the patient, while straining on the bed pan, split the lower portion of the abdominal wound through the anterior rectus abdominis sheath. The wound was closed and the patient was able to take sick leave on the sixteenth postoperative day. Examination 1 month later showed him completely free of symptoms with the abdominal wall well healed.

#### DISCUSSION

This case represents the most common of urachal anomalies consisting of a cyst of the urachal remnant. The umbilical sinus communicating with the abscess cavity may represent the portal of entry of

off; they may be absorbed or else persist and form cysts. They also state that definite proof of their theory "will come when someone is able to find a carcinoma developing in one of these cysts." In 1940 Peterson (6) reported an embryonal carcinoma of a mesenteric cyst in a 55-year-old white man.

Many classifications of mesenteric cysts have been offered. Peterson (6) divides all cysts of the mesentery into two groups. Under the first or embryonic group he includes: (a) Cysts arising from embryonic remnants and sequestered tissue which include serous, chylous, sanguineous, and dermoid cysts; (b) cysts arising by sequestration from the bowel, including Meckel's diverticulum; and (c) cysts of urogenital origin.

In Peterson's second group (pseudocysts) are included (a) those of infective origin, hydatids, and cystic degeneration of tuberculous nodes; and (b) cystic malignant disease.

Ladd and Gross (4) believe that true mesenteric or lymphatic cysts should be differentiated from cysts of enteric origin. They point out that these two types differ both as to their pathological picture and treatment.

The enteric cyst is a thick-walled structure with a serous coat, two layers of smooth muscle, and a mucous membrane lining, while the mesenteric cyst is thin-walled and has no muscular coat or mucosal lining. The wall of the latter consists of connective tissue; in some specimens there is a layer of flattened endothelial cells on the inner surface. These two authors further emphasize that anatomically the musculature of the enteric cysts is intimately associated with that of the intestine, and that its blood supply is the same as that of the adjacent gut. Consequently the enteric cyst cannot be removed without injury to the intestine and destruction of the blood supply of that particular segment. On the other hand, although the mesenteric cyst may lie against the mesenteric surface of the intestine "there is a line of cleavage between the two" so that the cyst can usually be removed without injury to the bowel or its blood supply.

On the basis of content, mesenteric cysts are of two types, serous or chylous. Those containing chylous fluid generally arise from the mesentery of the jejunum, where the material draining from the intestinal tract contains a high percentage of fat. The content of the serous cysts is similar in chemical composition to blood plasma.

Mesenteric cysts have been found in both infants and adults, the oldest reported patients being over 60 years of age (2). Incidence is highest in the fourth decade and lowest in the first and sixth. These cysts occur twice as frequently in women as in men (2) and occur mainly in members of the white race, although one has been reported in a Chinese boy (7).

Clinical symptoms due to mesenteric cysts are extremely variable depending upon the location of the tumor. They occur in any part of the mesentery but the jejunum and ileum are the most frequently involved. Occasionally smaller cysts may accompany the main one and confuse the clinical picture.

Warfield (2) has pointed out that these tumors are extremely mobile, especially in the transverse direction because of the nature of the mesenteric attachment, and that pain occurs more frequently than with any other type of abdominal cystic tumor. The size of the cyst and the pressure it exerts on neighboring viscera is another factor which may influence the clinical picture.

In a series reported from the Mayo Clinic (5) it was noted that "cysts with less than 2.5 cm. diameter failed to produce any physical signs or symptoms." However, these authors suggest that a sudden hemorrhage into a small cyst or twisting of its pedicle may produce an acute abdominal crisis.

Large cysts though incompletely filled and of soft consistency can, by their "saddle-shape structure" (4), compress or strangle adjacent intestine. The picture is that of partial or complete intestinal obstruction with chronic or acute symptoms, no different from those seen in obstruction from any other cause.

Tuberculous peritonitis is the diagnosis most frequently made pre-operatively when the cyst produces a painless abdominal enlargement. These tumors are difficult to palpate and demarcate because of their flaccidity. With large cysts it may be possible to elicit a fluid wave.

Roentgenological study, including films of the abdomen, gastrointestinal series, or barium enema, offers more diagnostic aid than any other laboratory procedure. Caskey (8) points out that these cysts appear as shadows of watery density displacing the intestines and stomach. Ladd and Gross (4) suggest that if roentgenological studies show that the mass lies in front of the intestines, it is more likely to be an omental cyst than a mesenteric tumor.

The most satisfactory treatment of any mesenteric cyst is complete surgical extirpation by dissection from the mesentery. Frequently, because the tumor is widely adherent to an adjacent portion of the intestine, part of the intestine must be excised with the cyst. Marsupialization of the cyst should not be done when excision is feasible.

#### CASE REPORT

D. S., a 10-month-old white boy was admitted to the hospital 29 May 1948. The mother stated that the child was vomiting, restless, and had had fever for 3 days. In addition the child had had no bowel movement for 2 days.

Birth history and past medical history were irrelevant except for occasional attacks of vomiting of 2 to 3 days' duration and failure to gain weight normally.

of vascularity. The blood vessels in some areas were dilated and contained naked blood cells.

**Diagnosis**—Findings are compatible with a diagnosis of lymphatic cyst of the mesentery.

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#### RADILOGIC OBSERVATIONS IN MESENTERIC THROMBOSIS, by B. A. Rendell and L. A. Harrington. American Journal of Roentgenology and Radium Therapy 52: 317-322, Sept. 1944

Rendell and Harrington reported three cases of mesenteric thrombosis, in two of which they postulated a diagnosis of mesenteric thrombosis. In a patient with a clinical diagnosis of intestinal obstruction, a roentgenogram of the abdomen showed gaseous distention of the small intestine and the right half of the large intestine, suggesting mechanical obstruction in the splenic flexure. Surprisingly the barium enema passed the site of the obstruction to fill the entire colon. This patient died and necropsy showed thrombosis of the superior mesenteric artery with gangrene of the small intestine, cecum, and part of the ascending colon, the regions corresponding to the distribution of superior mesenteric vessels. Harrington reported 4 additional cases with similar roentgenographic signs in which the diagnosis of mesenteric thrombosis was confirmed either at operation or necropsy.

This simple roentgenologic procedure offers a means for differential diagnosis in an acute abdominal surgical emergency where only early and prompt diagnosis will avert an otherwise inevitable catastrophe.—*Abstract*



# Cavernous Hemangioma of the Left Lobe of the Liver

## Report of a Case

FRANK E. HAMILTON, *Colonel, MC, U. S. A.*<sup>1</sup>

ROBERT H. HOLMES, *Lieutenant Colonel, MC, U. S. A.*<sup>2</sup>

**S**MALL, asymptomatic cavernous hemangiomas are more common than is generally believed. Such small hemangiomas are a frequent incidental finding at autopsy. Large hemangiomas are less common, and rarely does such a lesion attain the size of the one noted in this report.

### CASE REPORT

The patient was a 46-year-old Negress who had lived for the past 23 years in Panama. On 22 January 1949 she delivered her thirteenth child in Colon Hospital. Following delivery she noticed a nontender mass the size of an orange, deep in the left upper quadrant of her abdomen. She was discharged from the hospital to return later for further investigation of the mass. She returned in May. In the 4 months' interval the mass had increased in size and occupied most of the upper abdomen. A barium enema and gastrointestinal series were normal except for the displacement caused by the tumor. Numerous consultants examined the patient and concluded only that she presented a rapidly enlarging mass, apparently of a cystic nature. An exploratory laparotomy was performed on 22 July. A mass involving the left lobe of the liver was found, with sharp demarcation between an apparently normal right lobe and the tremendous tumor involving the left lobe. A biopsy was reported as a cavernous hemangioma of the liver. After an uneventful recovery the patient was transferred to the Gorgas Hospital.

On 11 August the abdomen was again opened through a long right rectus incision. A few dense adhesions had developed between the vascular mass, abdominal wall, and adjacent jejunum. After the release of the adhesions, this unusual tumor was found to measure 12 by 28 by 22 cm. and contained an estimated 1,000 cc. of blood. The left lobe of the liver was indistinguishable from the mass, and it appeared that the tumor was the greatly enlarged left lobe of the liver. The tumor occupied the entire left side of the abdomen and its lower pole extended below the brim of the pelvis. The distinction in appearance between the normal right lobe and the left lobe of the liver was so clear as to form a semblance of a pedicle. The hepatoduodenal ligament was incised and a careful dissection of the hepatic artery was accomplished. The right hepatic artery was identified and traced to the right lobe of the liver, and

<sup>1</sup> Gorgas Hospital, Ancon, C. Z.

a greatly enlarged left hepatic artery was traced to the tumor. The important adjacent structures were identified and found to be beyond the limit of the intended transection of the liver. Accordingly the left hepatic artery was doubly ligated and severed. Next, the left triangular ligament was severed, additional adhesions were released, and the left lobe was mobilized.

During this procedure the tumor was held out of the abdomen, and it was observed to decrease in size, to about half its original dimensions. It appears that with the left hepatic artery ligated the patient was, in effect, given an auto-transfusion from the tumor. The liver was quickly transected at the junction of the right and left lobes. Hemorrhage was controlled by digital compression. The larger intrahepatic vessels were individually ligated. Hemostasis was completed by inserting a series of interrupted mattress sutures of heavy silk. Convalescence was uneventful. The patient was discharged on the twentieth postoperative day. Frequent follow-up visits since that time indicate an apparent cure.

#### *Pathologist's Report*

**Gross findings**—The large, encapsulated, red brown mass measured 21 by 13 by 6 cm and weighed 1,050 gm. The capsule was thin and transparent. One surface exhibited a suggestion of a pedicle measuring 3 by 4 by 1 cm. The mass was soft and spongy but fibrous on cutting revealing a bloody meaty parenchyma. Two large fibrous trabeculae traversed the mass and radiating therefrom were many smaller, interlacing septins (fig. 1).

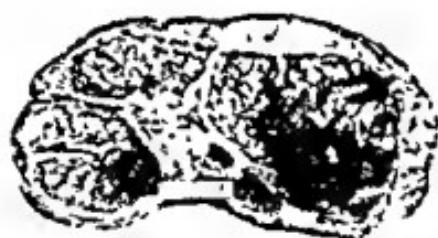


Figure 1.—Cut surface of hemangioma of liver. Note wide, fibrous supporting trabeculae and monotonous bloody, spongy architecture.



Figure 2.—Cavernous blood sinuses in juxtaposition with islands of liver cells and thickened anastomosing septa of blood sinuses.

**Microscopic findings**—Multiple sections showed an anastomosing vascular channels of variable size lined by elongated flattened cells resembling endothelium. Most of the sinuses contained blood. Occasional islands of liver cells were observed within this mosaic. There was a monotony of pattern with little cellular pleiomorphism (fig. 2).

**Diagnosis**—Cavernous hemangioma of liver.

#### DISCUSSION

In 1904 Albrecht (1) introduced the term "hamartoma" for certain vascular tumors of the liver which he considered to represent a malformation or developmental defect. This defect appeared to express itself as an abnormal combination of normal components of the organ, and could be one of arrangement, quantity, or degree of differentiation.

This concept and terminology has since been employed by many authors.

Multiple hamartomas have also been reported. Von Fallowsky (2) described an infant exhibiting nodules of vascular tissue in the liver, the spleen, and multiple angiomas of the skin. Turner (3) reported a case of arterovenous hamartoma of the brain. Moolten (4) pointed out that neurofibromatosis was possibly an instance of disseminated hamartoma. The existence of combined hemangioma of the cerebellum and retina is well established. Recently one of us saw two cases of congenital familial telangiectasia with multiple vascular lesions of the skin, mucous membranes, and a large pulmonary arteriovenous fistula. In one of the lungs four additional small hemangiomas were discovered. McDonald, Harrington, and Clagett (5) reported 23 cases of pulmonary hamartoma. Numerous cases of hemangioma involving bone are recorded. Congenital polycystic disease of the liver, kidneys, and pancreas is also quite familiar. Tuberous sclerosis is also incriminated in this galaxy of developmental tumors.

The relationship of the frequent cutaneous hemangiomas, apparently unrelated to visceral involvement, to the concept of Albrecht's hamartoma needs clarification. These vascular tumors wherever found are usually benign although instances of malignancy have occurred. Kaposi's metastasizing angiosarcoma if related to the hamartoma must represent a malignant mesenchymal variant. Stont (6) rejected many cases of supposed malignant vascular tumors. Most vascular tumors cannot be differentiated from hamartomas, or vascular malformations, the apparent tumor being caused by non-neoplastic enlargement of preexisting vascular tissue (7). Jaffe (8), Taylor and Moore (9), and De Navasquez (10) suggest that metastasis in certain cases is only apparent, being actually of multicentric origin. True malignant tumors of vascular origin are extreme rarities (11). Hastings-James (12) reported a fatal case of hemangioblastoma of the liver. The present case is concerned with a huge apparently benign hemangioma of the liver that was successfully removed. The history is somewhat alarming in that the mass grew to the size exhibited in about 6 months. The presence of an intact capsule and an accessible pedicle facilitated complete removal.

Gruenwald (13) pointed out that the age at which a disturbance takes place has often been considered as a criterion for malformation and birth has been set as the borderline, but he could not subscribe to this assumption since identical malformations may develop before and after birth. A disturbance of embryonic growth indicates a structural mutation with the factor of differentiation and rate of growth altered but not uncontrolled and the quality of function partially maintained. A disturbance of growth, such as cancer, in

postnatal or adult life, on the other hand, usually implies an anatomic, functional, possibly genetic mutation with the quality of differentiation regressive or lost, and proliferation uncontrolled. It is suggested that the hamartomas embrace features of both extremes. A hamartoma, therefore, is a developmental defect manifested by an overgrowth of tissue yet responsive to organized influences, exhibiting the quality of specific structural and functional differentiation as well as controlled rate of growth and benign natural history. The present case represents these features and as such can be considered a hemangio-hamartoma. The mechanism of formation can be explained as a disturbance of a mesenchymal vascular anlage, of unknown etiologic basis, but possibly heredopathic (14).

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# Benign Esophageal Stricture and Carcinoma of the Esophagus<sup>1</sup>

MILTON H. REDISH, Lieutenant (MCS) U. S. N. R.<sup>2</sup>

UNTIL 1941 only 31 cases of carcinoma of the esophagus arising at the site of chronic strictures of that organ had been recorded. In that year, Benedict (1) critically analyzed these cases and added 2 of his own. A review of this group reveals that 17 of the strictures followed lye burns, 2 resulted from foreign bodies, and 1 was congenital. The remaining 13 were "unknown" or of unreported causation. In the case to be presented, no background factor of known significance could be elicited. Of special interest is the youth of the patient.

## CASE REPORT

A 38-year-old white veteran was admitted to the Halloran Veterans' Administration Hospital on 13 May 1948 with a history of acute esophageal obstruction of 3 weeks' duration. Dilatation at another hospital had been only partially successful and obstruction had recurred.

*Past history*—At age 22 he had an episode of sudden esophageal obstruction requiring gastrostomy and repeated bouglage. After 1 month, dilatation was effected to the point where the gastrostomy was permitted to close.

The following years were uneventful until 1944 when he entered a station hospital in France for "battle fatigue." At that time he complained of some difficulty in swallowing large bolus of food. Roentgenogram showed a stricture of the upper one-fourth of the esophagus. In 1945 he was honorably discharged from service and continued his occupation (bakery wagon driver) until the present illness.

With the exception of evidence of recent weight loss (21 pounds) the physical examination was negative. Laboratory examinations were as follows: Hb., 11 gm per 100 cc., 5 million red blood cells per cu. mm., 8,000 white blood cells per cu. mm., and normal differential. The stools were repeatedly negative for occult blood. The urinalysis was negative, the blood proteins, 65 gm per 100 cc. with a normal A-G partition. The esophagram showed at the junction of the proximal and middle thirds of the esophagus, practically obliterating the lumen, an irregular ragged defect, 4 cm. in length, and several dentate projections, sug-

<sup>1</sup> Sponsored by the Veterans' Administration and published with the approval of the Chief Medical Director. The statements and conclusions published by the author are a result of his own study and do not necessarily reflect the opinion or policy of the Veterans' Administration.

<sup>2</sup> Halloran Veterans' Administration Hospital, Staten Island, N. Y.

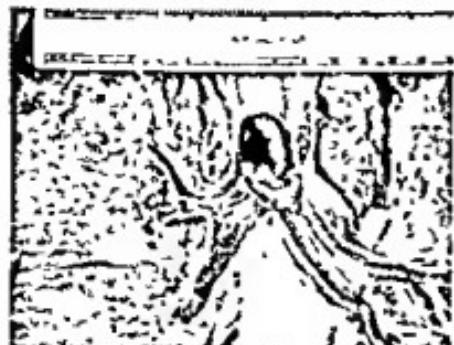


Figure 1.—Gastrotracheal fistula at necropsy

eration was completed without untoward incident. The carcinoma, which measured 3 cm in length, almost completely obstructed the lumen and penetrated to the outermost layers of the esophageal wall.

On the fifth postoperative day the patient was up and around and eating a soft diet. With the exception of transient discomfort substernally when he ate, he had no complaints and during the following 3 months he did remarkably well. There was a weight gain of 15 pounds but a persistent irritative cough appeared which became aggravated on swallowing food. Bronchoscopic examination in August 1948 showed an extension of the carcinoma into the trachea just above the tracheal carina. High voltage roentgen therapy was given without beneficial results. Jejunostomy was performed but the course was progressively downhill and the patient died 2 months after the latter procedure.

At necropsy a 35 by 25 cm perforation of the stomach into the trachea, approximately 4 cm below the level of anastomosis (fig 1), and metastases were present in the paratracheal region as well as in the right posterior chest wall and right visceral pleura.

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\* Dr. W. Chamberlain

# Sound Problems in the Air Force

DONALD H. ELDRIDGE, JR., *Captain, U. S. A. F. M.C.*

HORACE O. PARRACK, *Ph. D.<sup>1</sup>*

THE operations incident to the manufacture, test and flight of aircraft have always been noisy. The noise problem became so acute during World War II, particularly because of the adverse effects of noise on speech communication, that a great deal of effort was expended by both governmental and private laboratories in: (a) devising methods for suppressing noise generation (1); (b) designing sound-absorbing and sound-excluding treatments for the interior of aircraft (1) (2) (3); and (c) designing and constructing noise-excluding devices to be worn by personnel exposed to noise (4) (5).

Baranek (6) (7) discusses the effect of noise on comfort and safety in residential structures and has suggested possible solutions to these problems. Knudsen (8) in a more general discussion of noise as a hazard to safety, efficiency, and comfort has presented data on typical noise levels in streets, transportation facilities, work areas, and residential areas. He proposes the following as standard "Acceptable Noise Levels."

In hospitals	35 to 40 decibels.
In private offices	40 to 45 decibels.
In factories	45 to 50 decibels

The operation of conventional aircraft, both on the ground and in flight, is accompanied by sound levels in excess of the proposed "acceptable" maximum for factories (9). With the development of the jet power plant the noise levels have been greatly increased.

Various complaints, attributed to high frequency sound, have been and are being received from men who test and service jet engines and from pilots of jet propelled aircraft. From men working with jet engines on the ground, these complaints have included deafness; tinnitus; vibration of the head, teeth, abdomen, and chest; nausea; vomiting; unusual fatigue; and increased irritability both on the

<sup>1</sup> Bio-Acoustic Unit, Biophysics Branch, Aero-medical Laboratory, Air Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio

job and after hours. Pilots' complaints included acute fatigue, inability to concentrate, headaches, loss of flying "feel," numbness and detachment while flying, and sensations of faintness. This article deals with some of the known relationships of air-borne sound to the problems of supersonic speeds and sound of ultrasonic frequency.

Sound in the ultrasonic frequency range means sound at frequencies above the audible frequency range. The American Standards Association (10) has tentatively adopted the arbitrary range of 15 to 15,000 cycles per second (double vibrations per second) as the frequency limits of audible sound. While this seems to be a good generalization, many children and young adults with "perfect" ears can hear sound frequencies as high as 20,000 cycles per second and when the tones are loud enough some people can hear frequencies at least as high as 25,000 cycles per second (11) (12) (13). To what extent do such high frequency sounds exist? Every time one vocalizes a loud "peep" many measurable ultrasonic frequencies are produced. Compressed air escaping from a jet on the laboratory bench is an excellent source of ultrasonic frequencies.

Since the war microphones capable of measuring this high frequency sound have been developed and many such measurements made (14). Figure 1 shows the results of measurements made near a jet engine. Here sound pressure is plotted as a function of frequency. Immediately it is apparent that ultrasonic frequencies are present

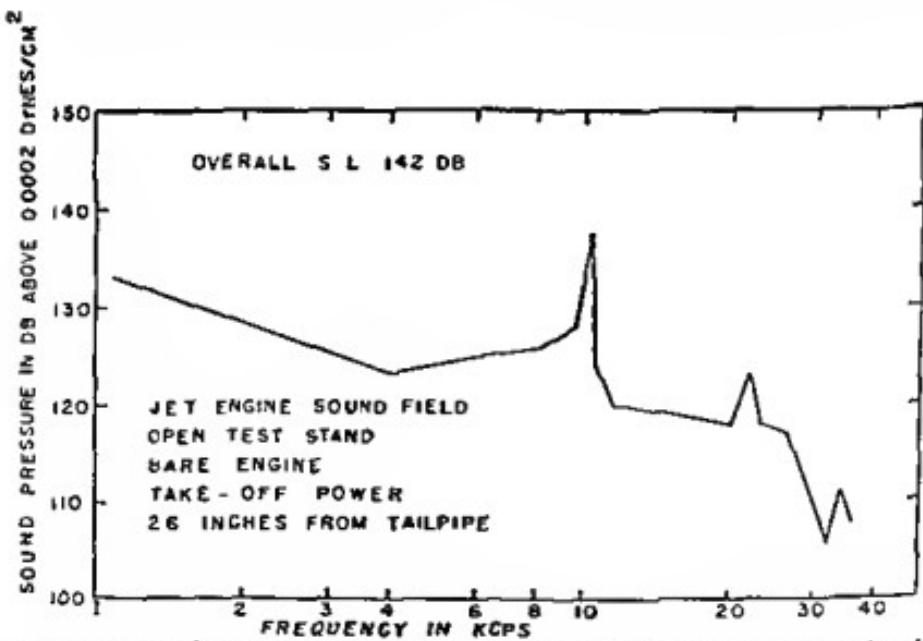


Figure 1.—Sound pressure as a function of frequency for a sound field produced by a turbo-jet engine (high frequency analysis, 400 cycles per second half-band width).

and that they are low in intensity compared to the audible sound frequencies present. To the best of our knowledge these are the highest sound levels in the ultrasonic frequency range that have been recorded either around jet engines or in jet aircraft. Sound in the audible frequency range at levels up to 120 decibels above the standard reference does not appear to be injurious to man except for effects on or through the hearing organ.

Does sound pitched too high for the human ear to hear in some mysterious way penetrate the body and cause damage of some sort at rather low intensities? As far as air-borne sound is concerned, such is not the case. These frequencies are almost totally reflected by the skin. Measurements of the sound reflection and absorption coefficients at various frequencies have been made for white rats and for man (15). For the white rat about 5 percent of the sound energy is absorbed at 400 cycles per second. This absorption drops to about 2.5 percent at 1,200 cycles per second and then rises to about 12 percent at 6,000 cycles per second. If the rat's fur is shaved off, the sound absorption again is 5 to 7 percent of the total sound energy present for a frequency of 400 cycles per second and this absorption decreases rapidly with increasing frequency until it is only 0.5 percent at 3,600 cycles per second. The absorption coefficient of rat fur alone has been shown to be about 1.5 percent at 400 cycles per second and increases with increasing frequency to about 7.5 percent at 3,600 cycles per second. Above 1,200 cycles per second the absorption coefficient for the fur alone is identical with that for the intact animal. We have no reason to believe that the absorption decreases again until much higher frequencies are reached.

When such furred animals as mice (16), rats, and guinea pigs (17), are placed in sound fields of the order of 155 decibels above the standard reference level the fur and body temperatures rise to lethal levels in very short times. Exposure of rats to radiant heat under appropriate conditions has caused death in approximately the same time, has brought about an essentially identical behavior during exposure, and has produced essentially identical pathologic changes. One must conclude that the absorption of acoustic energy from the sound field with conversion to heat and elevation of the body temperature is the primary cause of death.

At this point it might be well to point out that the decibel scale is logarithmic and that sound energy in a sound field that contains no standing waves or reflections increases as a square of the sound pressure. Thus an increase of 20 decibels means a tenfold increase in sound pressure and a hundredfold increase in sound energy. Or for another example, at 126 decibels the sound pressure is approximately twice and the sound energy four times their respective values at 120 decibels.

If we were to expose one of these animals to a sound field just three decibels less intense than one which would just kill him, he will be exposed to and absorb only one-half the lethal quantity of sound energy and should be able to reach a stable equilibrium with his environment. Experimentally this has proved to be true (18). The animal's temperature rises to 37° to 38° C. and becomes stable at that point. Following exposure to such a sound field for an hour or more the animal appears to be deaf but continues in good health in all other respects indefinitely. Thus it is clear that even the rat with his highly absorbent fur coat can survive quite well in sound fields of the order of 150 decibels above the standard reference.

Now man is not a rat and he does not normally wear a fur coat. The sound absorption coefficients for man vary with frequency as they do for a shaved rat except that they are even lower (15). At a frequency of 400 cycles per second man's skin absorbs about 48 of the total sound energy. The absorption coefficient decreases rapidly with increasing frequency until it is less than 0.5 percent at 6,000 cycles per second and even less at 18,000 cycles per second. The difficulties of measuring such small absorption coefficients are such that it is impossible to give exact figures. At the present time there is no reason to believe that this absorption coefficient rises at even higher frequencies. Men exposed to ultrasonic frequencies produced by a siren in the laboratory at levels 40 decibels higher (100 times the sound pressure and 10,000 times the sound energy) than have been found around jet engines have noticed no ill effects. It thus becomes highly improbable that air-borne sound in the ultrasonic frequency range, even at higher intensities than we have found to exist anywhere but in the laboratory, will be harmful to man.

This would seem to contradict much of the work and many of the statements appearing in the literature on the subject of ultrasonics. For many years small crystal ultrasonic generators have been used to disrupt bacteria and micro-organisms, to accelerate chemical reactions, and to produce destructive lesions in laboratory animals (19) (20) (21) (22) (23). Horvath (24) (25) (26) in Germany and Heimick (27) in this country at the Mayo Foundation have been investigating the use of such ultrasonic generators in the treatment of cancer. In all of this work contact between the crystal generator and the exposed material was made through an oil or water medium from which air had been carefully excluded. Under these conditions surface reflection phenomena are minimal and nearly all of the sound energy generated by the crystal is absorbed in the exposed biological material thereby heating or otherwise disrupting the structure. The conditions for ultrasound in air are quite different. Sound energy at high frequencies in air is almost completely reflected by any liquid or

solid surface. Much of the confusion concerning ultrasound as an Air Force hazard arises from the mistaken inference that the results obtained with fluid-coupled generators are valid for an borne sound. They are not.

The bulk of the aeromedical sound problem is thus confined to the audible sound frequencies. Figures 1 and 2 show that sound levels in excess of 130 decibels may be expected from a few hundred cycles per second up to 10 or 12 thousand cycles per second. At some frequencies the level may be as high as 140 decibels with this particular engine, and with more powerful engines we have found the sound level to be as high as 150 to 160 decibels.

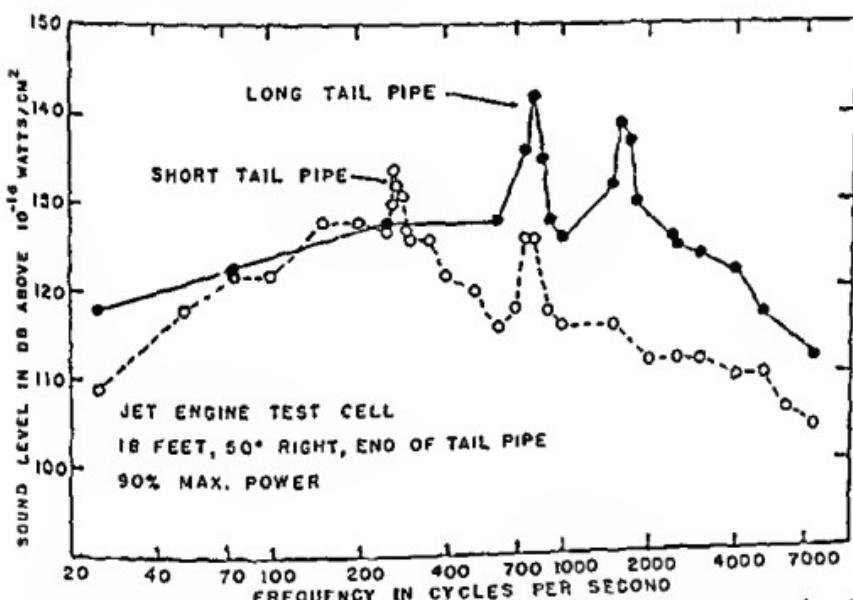


Figure 2.—Sound pressure as a function of frequency for a sound field produced by a turbo-jet engine (low frequency analysis, constant percentage band width, down 3 decibels at 1 percent of tuned frequency).

Obviously the ear is of first importance when considering sound in the audible frequency range. At about 120 decibels most persons feel a tickling or uncomfortable sensation in the ear. The threshold for pain in the ear varies with individuals, but most will feel pain by the time sound levels have reached 140 decibels (28). Judging from a single case where rupture of the drum occurred in a known sound field, one can expect rupture of the drum to occur at a sound level of about 160 decibels (29).

Davis et al. (30) have shown that significant temporary hearing losses will occur after exposure to pure tones or to band spectrum noise for 4 to 8 minutes at levels of 120 decibels above the standard reference. By temporary deafness we mean a deafness that follows

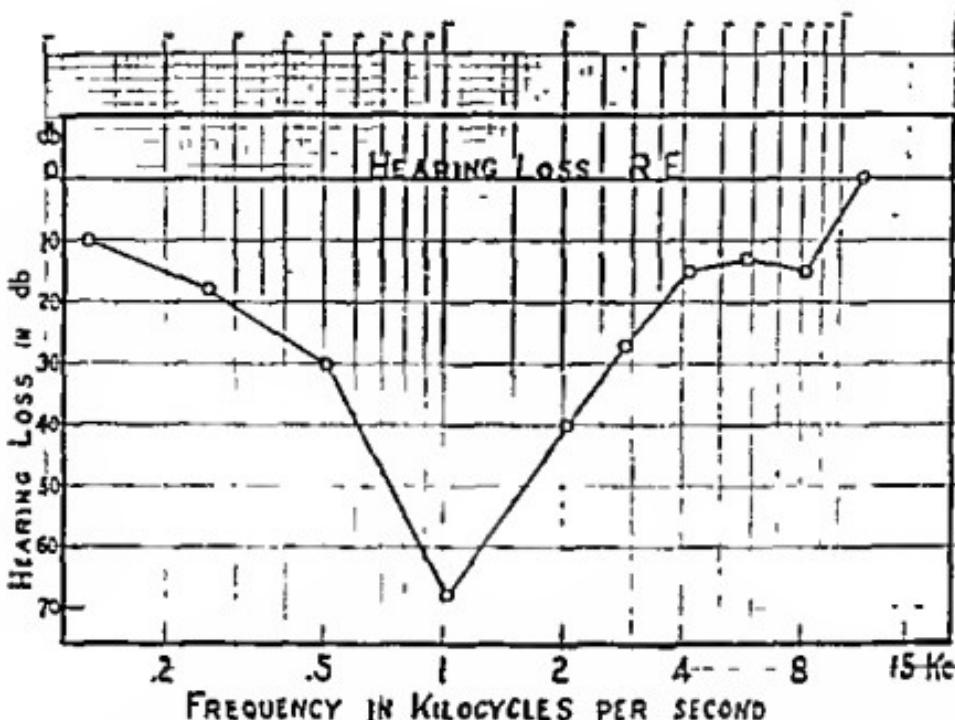


Figure 3.—Hearing threshold loss as a function of frequency following a 10-minute exposure without ear defenders to jet engine noise at 146 decibels above the standard reference level.

overstimulation, is not permanent, and is apparently due to fatigue of the end organ. Longer exposures at intensities of 110 decibels or shorter exposures at intensities higher than 120 decibels will give similar hearing losses. Since a jet engine will produce sound pressures at least as high as 130 decibels throughout the speech frequency range (300 to 4,000 cycles per second) it seems obvious that the unprotected ear will suffer from exposure to such noise. Figure 3 shows the hearing loss that existed 12 minutes after an ear had been exposed for 10 minutes, without ear defenders, to a 146-decibel over-all sound level near the exhaust of the jet engine whose sound field is presented in figure 1. The hearing loss is in excess of 30 decibels throughout the frequency range 500 to 2,000 cycles per second. This is the most significant frequency band for the perception and understanding of speech.

During the last war considerable effort was directed toward providing means of protecting the ears of men who fired guns, operated tanks, flew in aircraft, worked in factories, and tested engines. In most cases, where continuous noise was encountered, the sound level was less than 125 decibels. The result of this effort (4) (5) was the V-51R ear defender, a small insert-type ear plug made of either vinylite or neoprene. When various factors such as size, weight, comfort, chemical and physical irritation of the external canal, available

materials, et cetera, are considered, it seems that the V-51R excludes sound from the ear about as well as an insert-type defender can do. Under optimal conditions of fit the V-51R provides:

- 26 decibels sound attenuation at 100 and 250 cycles per second
- 29 decibels sound attenuation at 500 cycles per second
- 31 decibels sound attenuation at 750, 1,000, and 1,500 cycles per second
- 35 decibels sound attenuation at 2,000 cycles per second.
- 36 decibels sound attenuation at 2,500 to 8,000 cycles per second

For sound levels up to 125 decibels it can be seen that the V-51R is reasonably adequate protection, reducing the sound level at the ear to less than 100 decibels. Using this same sound attenuation data, it can be calculated that at a frequency of 1,000 cycles per second and an intensity of 140 decibels the sound level at the ear would be reduced only to 110 decibels. Davis et al. (30) have shown that sizable temporary hearing losses may be produced by a 1,000-cycle per second tone at 110 decibels.

The hearing loss shown in figure 4 resulted from an incidental exposure to a "synthetic" sound field and demonstrates these limitations of the V-51R. The sound field was generated by a laboratory siren inside an anechoic room. Standard V-51R ear defenders, carefully fitted to the subject's ears were worn throughout the exposure. The

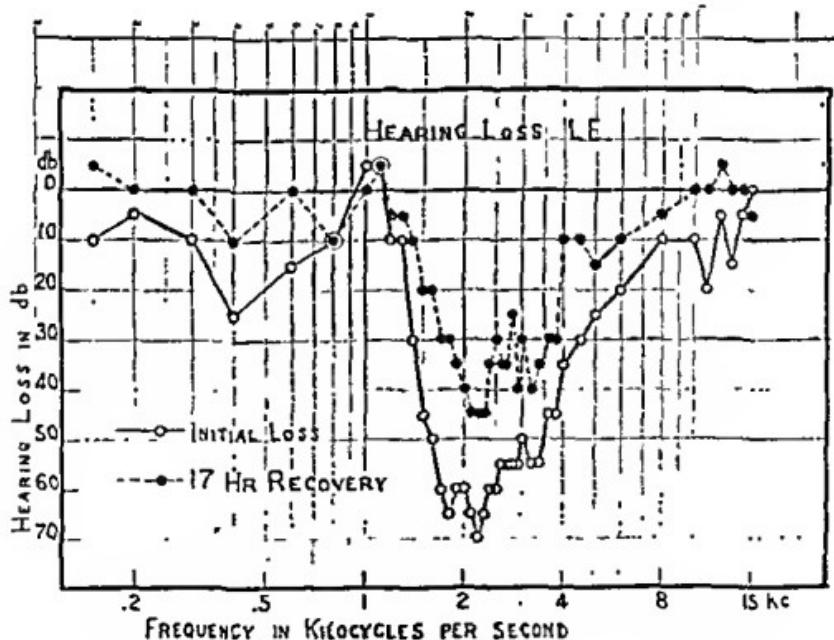


Figure 4.—Hearing threshold loss as a function of frequency following exposure to siren sound field.

in the noise field. After 3 days considerable recovery occurred but at the end of 30 days there was very little more recovery of auditory sensitivity and the hearing threshold was still appreciably depressed. This hearing loss may be permanent. In addition many cases were found where the total hearing loss increased steadily as shown by audiograms taken over a 6- or 12-month period. It appears probable that those persons who exhibit progressive hearing loss with increasing time of exposure to noise will be permanently deaf as a result of the repeated "acoustic trauma."

In addition to the temporary deafness and possible permanent deafness previously discussed, the ear is subject to masking of desired speech or code signals by undesired noise. Any sound is said to produce masking when it raises the threshold of audibility of a second sound (33).

The effectiveness of a sound as a masking noise depends about equally on its frequency components and its intensity (34). Of course, if the desired signal is as loud or louder than the noise, it can be heard. Also if the masking noise is louder than the desired signal but contains only frequencies much lower or higher than the desired signal, the signal will be heard. Although one can talk and be understood through the noise of hammering or the 75 to 150 cycle per second noise produced by a reciprocating engine with a propeller, it is much more difficult to do this in the presence of noise produced by rubbing two pieces of sandpaper together or in the presence of the hiss of aerodynamic noise.

It is usually accepted by pilots that the B-25 is a very noisy airplane and that the F-80 is a very quiet one. It is true that in the frequency bands from 20 to 300 cycles per second which contain the engine and propeller noise, the sound levels of 110 to 115 decibels inside a sound-treated B-25 (11) are 6 to 13 decibels higher than they are in an F-80. However, in the frequency bands from 300 to 4,800 cycles per second the sound levels in the F-80 (35) of 112 to 114 decibels are 9 to 22 decibels higher than they are in the B-25. While the lack of very low frequency sound and vibration in a jet aircraft and the noise excluding properties of helmets give the pilot and crew the impression it is a quiet airplane, direct speech communication is nearly impossible due to the high level masking noise in the speech frequency spectrum. It is indeed fortunate that helmets and headsets with doughnut type seals are much better for excluding noise in this frequency range than they are for excluding propeller noise.

It has been pointed out that while sound frequencies above 6,000 cycles per second are very poorly absorbed by human skin, 4 to 8 percent of the sound energy may be absorbed at lower frequencies. For frequencies below 2,000 cycles per second, intense sound of the

order of 150 decibels becomes a problem for parts of the body other than the ear. Using a laboratory siren generating sound levels between 150 and 170 decibels some interesting phenomena have been observed in man at these low frequencies (17). At frequencies from about 1,500 cycles per second down to about 700 cycles per second there is a sensation of marked vibration of the cranial bones. At certain of these frequencies the sensation of vibration from the jaw is so strong that one reflexly grits his teeth in an effort to stop the vibration.

There is also a sensation of vibration combined with air movement in the nasal passages and bony sinns. A similar sensation is noted in the mouth and pharynx, especially when the mouth is open. At certain frequencies, which have not been precisely determined, in the range 700 to 1,500 cycles per second, the vision may become blurred when one stands in the sound field. Recovery is immediate and complete as soon as one steps out of the sound field. As the frequency of the sound field to which one is exposed is still further decreased, the sensations of vibration are felt in the thorax, abdomen, and in single muscles or muscle groups of the arms and legs.

The sensations of vibration that have been observed in the laboratory at known frequencies and intensities of the sound field are identical with sensations observed when standing near the tail pipe of a jet engine on an outside test stand. Where standing wave patterns may be produced in enclosed test cells these phenomena are more distinct.

There have been occasions both in the laboratory and at jet engine test stands when personnel have observed a "weakness" in the knees or an apparent general weakening of the body supporting musculature. This sensation is usually not accompanied by faintness or vertigo. It would appear to result from some effect on the proprioceptive reflex mechanism, since, with conscious effort, one can maintain his posture and move about. At higher sound levels in this frequency range a few subjects have experienced vertigo in addition to the weakness described. During short exposures none of these vibratory sensations are accompanied by pain or after effects so that it is doubtful that gross physical damage occurs. Yet even experienced observers feel considerable discomfort and apprehension in these sound fields. Such loud low frequency sounds instinctively mean danger to a man. After exposures of 30 minutes or so fatigue, irritability, and a feeling of being slightly dizzged have been observed. So far the modes of action and physiologic changes which accompany these reactions have not been adequately studied. Due to the bulkiness and weight of materials that would be required to insulate a man from such sound and vibrations, structural sound

insulation rather than personal equipment seems to be the practical approach for any protective measures necessary.

In the case of engine test facilities much progress has been made along this line. However, experience has shown that even well-designed and well-insulated control rooms and work areas fail to exclude sound when workmen fail to close windows and doors or fail to seal up the space around fuel and control lines running between control rooms and the engine test bed.

In conclusion it can be stated that sound above the audible frequency range is not currently a serious hazard. The knowledge of the existence of such sounds and in some cases the presence of annoying sounds in the upper audible frequency range may be psychologically disturbing to some persons. However, three major sound problems do exist. The first is the problem of deafness, both temporary and permanent. By the use of both insert-type and external ear defenders adequate protection may be expected in any sound field that is not so intense or so low in frequency as to be disturbing to the body as a whole. The second problem is the one of masking of speech in communication systems. Sound insulation for these frequencies is not too difficult and appropriate headphone and microphone design can be expected to provide satisfactory solutions. The third problem is the intense low frequency sound which is felt by the body as a whole. To date the only solutions seem to be spatial isolation and/or structural isolation in the form of engine mufflers and sound-proofed buildings.

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# Medical Plans for Civil Defense and Disaster Relief<sup>1</sup>

WILLIAM L. WILSON, Colonel, MC, U. S. A.

**I**N THIS brief presentation it is hoped that we may achieve orderly thinking and make concrete suggestions of use to local and State committees in planning the medical phase of civil defense and disaster relief. Without a great deal of forethought, prolonged training, and the development of systematic performances, drills, and tests of all participants, no community can prepare itself to provide those additional health services that will be essential for civilians subjected to disasters. When the average community prepares itself for disasters the effort of each citizen and every profession must be fitted into a coordinated system. Whoever guides each part of the whole must have a clear concept of the working of all other parts. There is no easy road to medical preparedness for disasters.

There are two opinions as to local disaster planning. One maintains that no local planning is justified until an authoritative central agency is established to prescribe a uniform pattern for each locality. Such a regimented approach, if implemented, would result in a speedy realization of the desired total readiness. Certain elements of local plans would depend on such a system if mutual support between communities were to be achieved with maximum economy and efficiency. Such a system is the only one likely to survive major war disasters. A second group, maintaining that every community should proceed immediately with its own preparations for meeting disasters, is more realistic. Such a plan would not interfere with any national scheme to be devised later. Each community can lay the necessary groundwork in interim plans and at the same time improve its own and others' readiness to meet many problems that may never require intercommunity participation. Above all, much time and effort can be saved because such planning will be required with or without a uniform national pattern.

Several States and communities have already set up their own flexible schemes, readily adaptable to mutual support or national parti-

<sup>1</sup> Condensed from an address presented at Joint Meeting of Third Army Area Medical Department Reserve Officers and Fulton County Medical Society, Ga., 20 October 1949. Full text available on request to the Surgeon General, Department of the Army, Washington 25 D. C.

pation. None of them should find undue difficulty in adjusting to a future national pattern. No community should go so far in its plans as to provide greater reserve stocks of litters, ambulances, and medical supplies than could be readily used. On the other hand, no community can justify prolonged ignorance of its immediately available resources or neglect the writing of simple, feasible plans and institutions that may be implemented with a reasonable prospect of success. Even if an ideal national plan were produced overnight, it would not permit formation of unchanging national or local plans. Since in the development of any local, State, and national plans it is inevitable that changes will be necessary from time to time, delays to prevent later changes of local plans to meet national schemes will never be justified. This discussion deals with interim plans, that may be reasonable pending the advent of a national plan.

Certain essential activities in an interim disaster medical plan, if not previously considered, should be undertaken without further delay and generally in the following order: (a) Fixing responsibilities for all necessary activities;<sup>2</sup> (b) establishing necessary authority for meeting these responsibilities;<sup>2</sup> (c) classifying responsibilities and authorities as already adequately covered or not; (d) providing means for developing services not adequately covered;<sup>2</sup> (e) keeping a record of functions to be performed; and (f) developing a system of reporting every person treated.

As indicated above, legislation may be needed to fix responsibility, insure proper authority, and provide the means for additional civilian health activities required for disaster relief or civil defense. In civil defense this should be limited to organized civilian activities (a) to minimize the effects of any enemy action directed against the United States or other area which is a responsibility of the United States, and (b) to maintain or restore those facilities and services that are essential to civilian life, and are affected by such enemy action. A disaster will be considered to be a situation in which numbers of persons are plunged into helplessness and suffering and as a result may be in need of food, clothing, shelter, medical care, and other necessities of life. In disaster relief planning, therefore, the following premises should prevail:

1. Civilians should control and implement all civilian health services.<sup>3</sup>

<sup>2</sup> May require legislative action.

<sup>3</sup> Under existing law, civil administration could call for temporary military aid to the civil authority. The Hooper Civil Defense plan recommended certain military responsibilities, including final reliance on the Army for support in the event civil efforts were overwhelmed or became exhausted. That must not occur, but if it should the civil administration must be reestablished as soon as possible. To do otherwise might result in diversion of military medical resources from primary missions. The measure of our efficiency would be the speed with which the civil administration could be reestablished.

2. All responsibility to a military or civilian community for functional results rests on a military commander or a civilian administrator, respectively.<sup>4</sup>

3. Military participation may take one or more of several forms: (a) Following a disaster, if the civil administration continues to operate, the Army may provide supplemental assistance, usually in the form of medical supplies or food; (b) following a natural disaster in peace or war the Army may provide medical supplies, sanitary aid, and other supportive measures as requested by the Red Cross or the States, and always with legal sanction; (c) under conditions of martial law, civil laws are administered by a military commander; (d) under conditions of military government the commander, subject only to the laws of war and to the instructions of his own civil government, prescribes such measures regarding health as he deems necessary, depending on the recommendations of technical advisors.

4. The functional planning and administration of your programs must be integrated by respective heads of civil and military administrations, to achieve which we must insure that (a) local military and civil administrators are thoroughly familiar with the scope and limitations of their functions; (b) those authorities comprehend the relationships that must exist between them, as well as with their respective superiors; (c) civil administration will be reestablished as soon as possible; and (d) civilians will function under civil control, with minimum military supervision or interference.

In developing community relief services not adequately covered their quantity and quality will depend on the location and type of disaster encountered. The community to furnish the relief services and the organizations responsible for specific functions must be clearly understood. An estimate of potential situations must have been made to permit provision of means (table 1). The categories and quantities of resources required must have been determined (table 2).

Since the limiting factor in any plan will be sufficiently trained personnel to perform the necessary functions, an inventory of available personnel is one of the earliest requirements (table 3). For this purpose personnel in public health services, in teaching institutions, and in any of the regular or reserve and civilian components of the Armed Forces must be considered unavailable. Specialists certified by the American specialty boards should be listed separately. With this information available, we may allocate geographically personnel to all public health, general medical, and specialist team functions.

<sup>4</sup>This is proper, for health officers have authority derived through the military commander or the civilian administrator. On the other hand the health personnel must make certain that each administrator has made all necessary arrangements for the health services.

**TABLE 1.—Potential situations requiring interim medical plans for civil defense and disaster relief**

[Request by Col. William L. Wilson, M.C., U.S. Army, © September 1949]

Community or place of disaster or event	Community required to furnish initial health services	Community requiring services	Source for additional health services when own are overtaxed		Community to furnish services for survivors	Community in which services may need to be provided
			(Own stand alone)	(Own stand alone)		
Own only	Own	Own only	Own stand alone	Own stand alone	Own	Own
Other only	Other	Other only	Another community.	Own stand alone	Own+Others	Own+Others
Own+Other	Own+Other	Own+Other	Other employed	Own stand alone	Own	Own
			Other unemployed	Own stand alone	Own	Own
			Other+Others	Own stand alone	Own	Own
			Own+Others	Own stand alone	Own	Own
			Own+Other unemployed	Own stand alone	Own	Own
			Own+Other employed	Own stand alone	Own	Own
			(Own+All others)	(Own+All others)	(Own+All others)	(Own+All others)

Medical matériel resources should be listed according to whether they are used in public health or medical-care services. Few, if any, changes to normally effective public health services will be required except for quantitative expansion unless it is for additional functions to minimize casualties from atomic, biologic, psychologic, and chemical warfare. Table 4 indicates a method for inventory of immediately available hospital beds. In a similar manner the interim plan must include inventories of medical supplies (table 5) and medical transport (table 6) required for public health, therapeutic, and evacuation services.

The administration of a disaster relief plan requires detailed recording of functions to be performed. We have touched all too lightly on fixing responsibilities and providing authority, and essential means. These must be recorded and sufficiently disseminated to all concerned. Written notice of appointment should be sent to persons responsible for (a) preparation and maintenance of all plans; (b) procurement and assignment of personnel; (c) budgeting, procuring and disbursing funds, (d) establishing, publishing, supervising, and controlling policies, procedures, training programs, and training guides, (e) publishing operational systems and functions; and (f) activating, organizing, administering, and training functional units, such as first-aid personnel individually or in squads; litter-bearing squads; casualty-collecting teams; casualty clearing stations, ambulance drivers, attendants, shock treatment teams; blood and blood derivatives services, general surgical, orthopedic, maxillofacial, thoracic, neurosurgical, abdominal, and vascular surgical teams; burn treatment teams, chemical casualty treatment teams; radiologic casualty treatment teams; psychiatric and psychologic teams; infectious disease treatment teams, and epidemiologic teams. The exact components of these teams have not been prescribed. The organization of such teams in this interim period not only does not need to be uniform, but by their diversity and varied effectiveness will provide valuable experimental information tending to result in the most efficient types.

For interim planning the necessary medical equipment, supplies, transport and other material means should come from normal supply sources. Local efforts to standardize equipment within a community or between mutual-support communities should not be undertaken until national direction has been furnished. There must be written plans and instructions, based on the material inventories, for the procurement, storage, issue, replenishment, repair, and maintenance of (a) hospital plant facilities, (b) medical equipment and supplies, (c) patients' food and feeding, and (d) medical transport in the form of medical personnel-carrying vehicles, cargo vehicles, ambulances, and other patient-carrying vehicles.

TABLE I.—Hospital beds immediately available in sample city for disaster relief

Quarter of city	Name of hospital	Beds (full surgery)	Emergency (floating)	Address	Number of beds in hospitals with adequate space		Number of beds in improv'd hospitals		Total
					In regular use	Not in regular use but ready for emergency	Total with emergency beds	Normal use of space	
Northwest.....	C.H.Y. ....	Dunks.....	4th and Main	900	200	1,100	1,200	...	3,150
		Alfrey .....	5th and Locust	165	10	175	175	...	450
	St. Thomas.....	Lee and Grand	1425 Grand	150	-	150	150	...	775
		Charity .....	Lee and Front	900	50	950	950	...	4,375
		Jackson Academy	16th and Leigh St.	175	20	195	200	School dormitory 150	...
		Tom's warehouse	11th and Front	...	...	...	Dry storage 300	University dormitory (3 miles).	...
	<b>Subtotal</b> .....	<b>2</b>	<b>6</b>	<b>2,290</b>	<b>290</b>	<b>130</b>	<b>2,700</b>	<b>450</b>	<b>3,150</b>
Northeast.....	Worley.....	2115 Main..	...	450	-	450	450	...	450
<b>Subtotal</b> .....	<b>1</b>	<b>1</b>	<b>1</b>	<b>450</b>	<b>0</b>	<b>450</b>	<b>450</b>	<b>0</b>	<b>450</b>
Southwest.....	Maternity .....	University .....	Ely and First	0	-	0	75	Dormitory 700	University
<b>Subtotal</b> .....	<b>1</b>	<b>1</b>	<b>1</b>	<b>70</b>	<b>5</b>	<b>75</b>	<b>700</b>	<b>700</b>	<b>775</b>
Southeast.....				2,810	285	120	3,235	1,150	4,375
<b>Subtotal</b> .....	<b>4</b>	<b>6</b>	<b>6</b>	<b>2,810</b>	<b>285</b>	<b>120</b>	<b>3,235</b>	<b>1,150</b>	<b>4,375</b>

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TABLE 5.—*Sample inventory of medical supplies—interim medical plans for civil defense and disaster relief*

Last day item required	Available at all times		Required		Shortages		Sources for making up shortages*		Time required to provide for shortages	
	In City	Out	NW	NP	RW	NP	NW	NP	RW	NP
Blood and derivatives	-	-	-	-	-	-	-	-	-	-
Trusses, biologic materials, and antitoxins	-	-	-	-	-	-	-	-	-	-
Surgical dressings and bandages	-	-	-	-	-	-	-	-	-	-
Surgical instruments and instruments for field kits	-	-	-	-	-	-	-	-	-	-
Shock team equipment	-	-	-	-	-	-	-	-	-	-
Laboratory equipment	-	-	-	-	-	-	-	-	-	-
Dental supplies (from stores)	-	-	-	-	-	-	-	-	-	-
X-ray supplies*	-	-	-	-	-	-	-	-	-	-
Miscellaneous hospital and medical supplies*	-	-	-	-	-	-	-	-	-	-
Panitary supplies*	-	-	-	-	-	-	-	-	-	-
Oils, soaps	-	-	-	-	-	-	-	-	-	-

TABLE 6.—*Sample inventory of medical transport—interim medical plans for civil defense and disaster relief*

Vehicles required for arriving at field problems until first day of problem	Number available at all times in city		Number required		Number required to be made up	
	NW	NP	RW	NP	NW	NP
Motor ambulance	-	-	-	-	-	-
Motor truck	-	-	-	-	-	-
Vans	-	-	-	-	-	-
Large carts	-	-	-	-	-	-
Small carts	-	-	-	-	-	-
Motor boats	-	-	-	-	-	-
Cables at field	-	-	-	-	-	-
Trees	-	-	-	-	-	-
Blankets	-	-	-	-	-	-
Blankets and vehicles of 1 kips	-	-	-	-	-	-

A scheme for hospitalization and evacuation of patients must be prepared, published, and understood by all concerned. Hospitals provide the basis for the whole system, so a hospital plan similar to that shown in figure 1 may be set up initially. After being tested by drills and experience, changes may be readily made to fit local conditions. As hospitals receive patients and approach capacity performance, provision must also be made for moving convalescent or well patients to other facilities or to their homes. A sample hospital evacuation scheme is illustrated in figure 2. The control of the flow of patients must be assured by establishing a medical regulating office for sections of the city, for the whole city, and for the State. The handling of patients from the application of first aid to their return to normal duties is shown in figure 3.

A records and reporting system referable to every person treated in civil defense or disaster relief must be developed and established in every instance in which the usual medical and health records and reporting will not fully meet requirements. The public must be brought to cooperate by wearing indestructible identification tags. Thus, a casualty, even though unable to talk or furnish self-help could be identified, his family notified, his property rights protected and later his insurance, compensation, or pension rights established. Each civilian medical unit must maintain a register of cases treated.

#### SUMMARY

Civil defense and disaster relief require the early assignment of responsibilities to persons throughout this scheme for: (a) directing, controlling, and supervising operations; and (b) coordination between their respective units and all others, particularly for mutual support.

Local civil defense and disaster relief plans must be integrated with military plans by means of (a) a simple classification of the entire adult population with regard to physical and temperamental fitness for essential duties in an emergency; (b) developing standards of the minimum of health services that would suffice, thereby insuring proper priorities in allocating personnel and matériel; (c) inventory of civilian medical resources, using terms that would make comparison between civilian and military resources easily understandable; (d) obtaining uniformity in classification of health personnel and in their organization into units of a type that would be equally adjustable to civil or military administration in wartime, could be transferred from one control to another with facility, and could be used with economy and efficiency by either; and (e) indexing our aggregate medical and health resources. The matter will be difficult, but can be achieved by cooperation and diligent study on the part of all concerned.

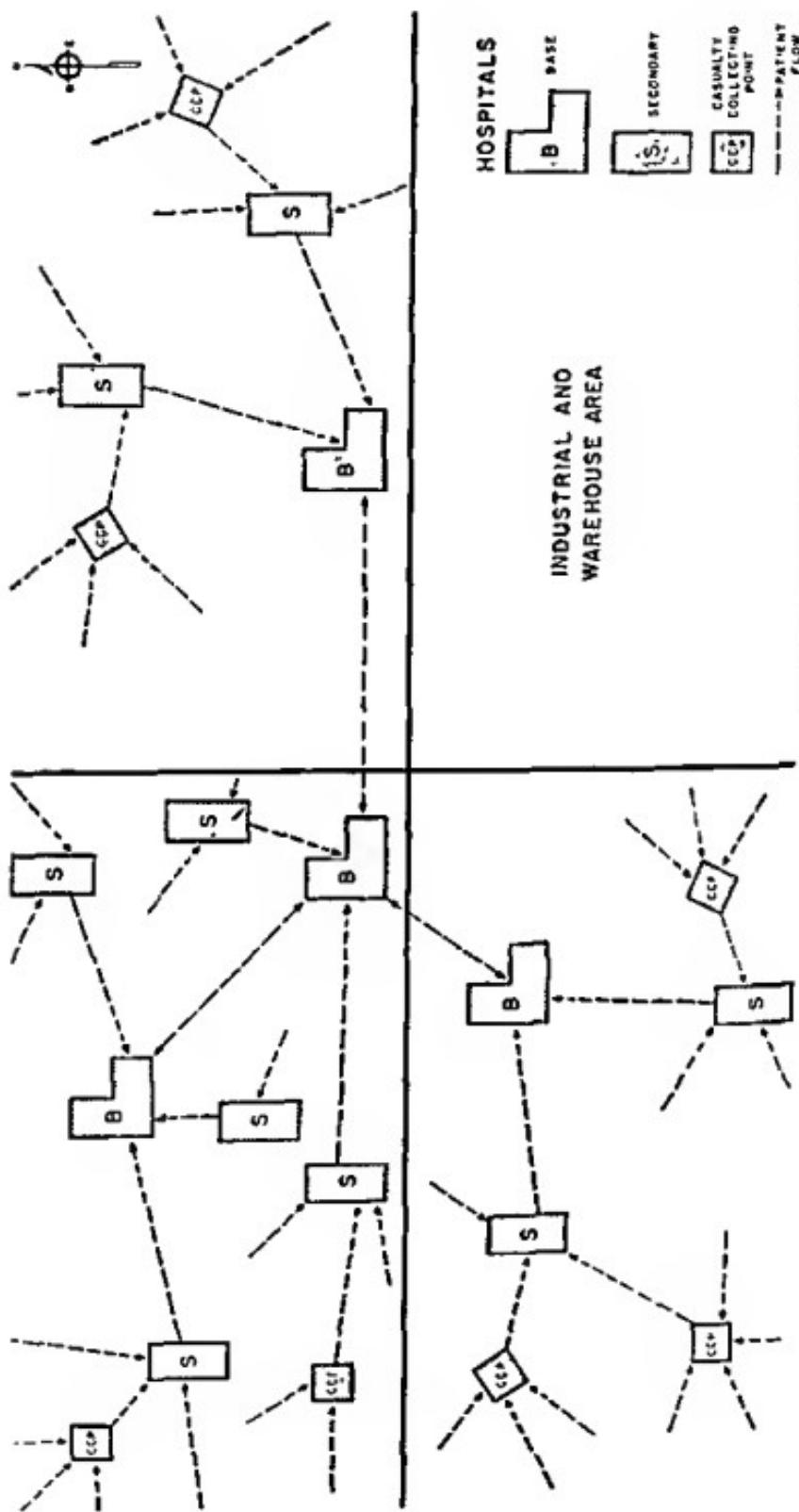


Figure 1.—Sample city. Hospital plan for disaster control.

—PREPARED BY COL. WILLIAM L. WILSON MC, U. S. ARMY (© SEPTEMBER 1949)

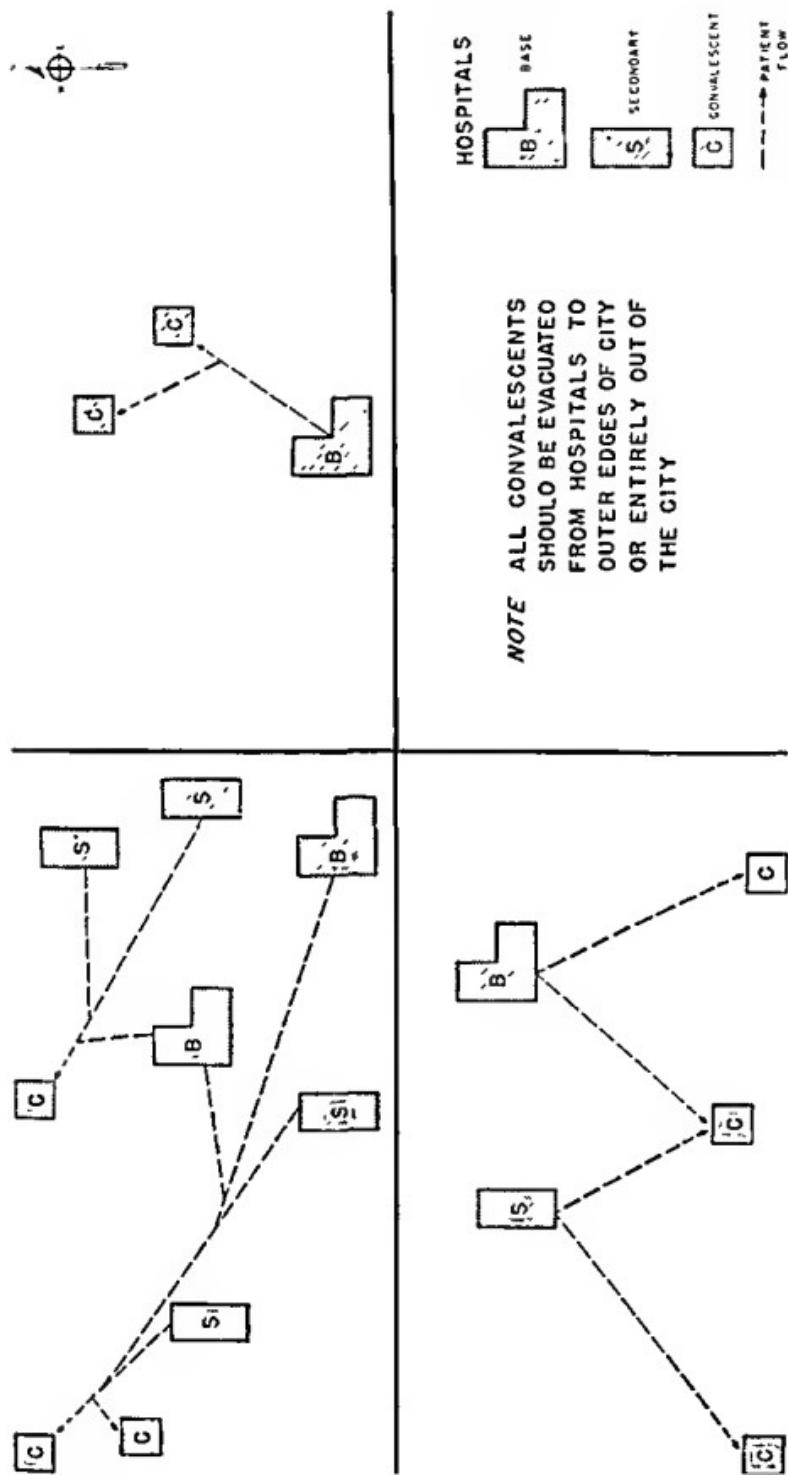
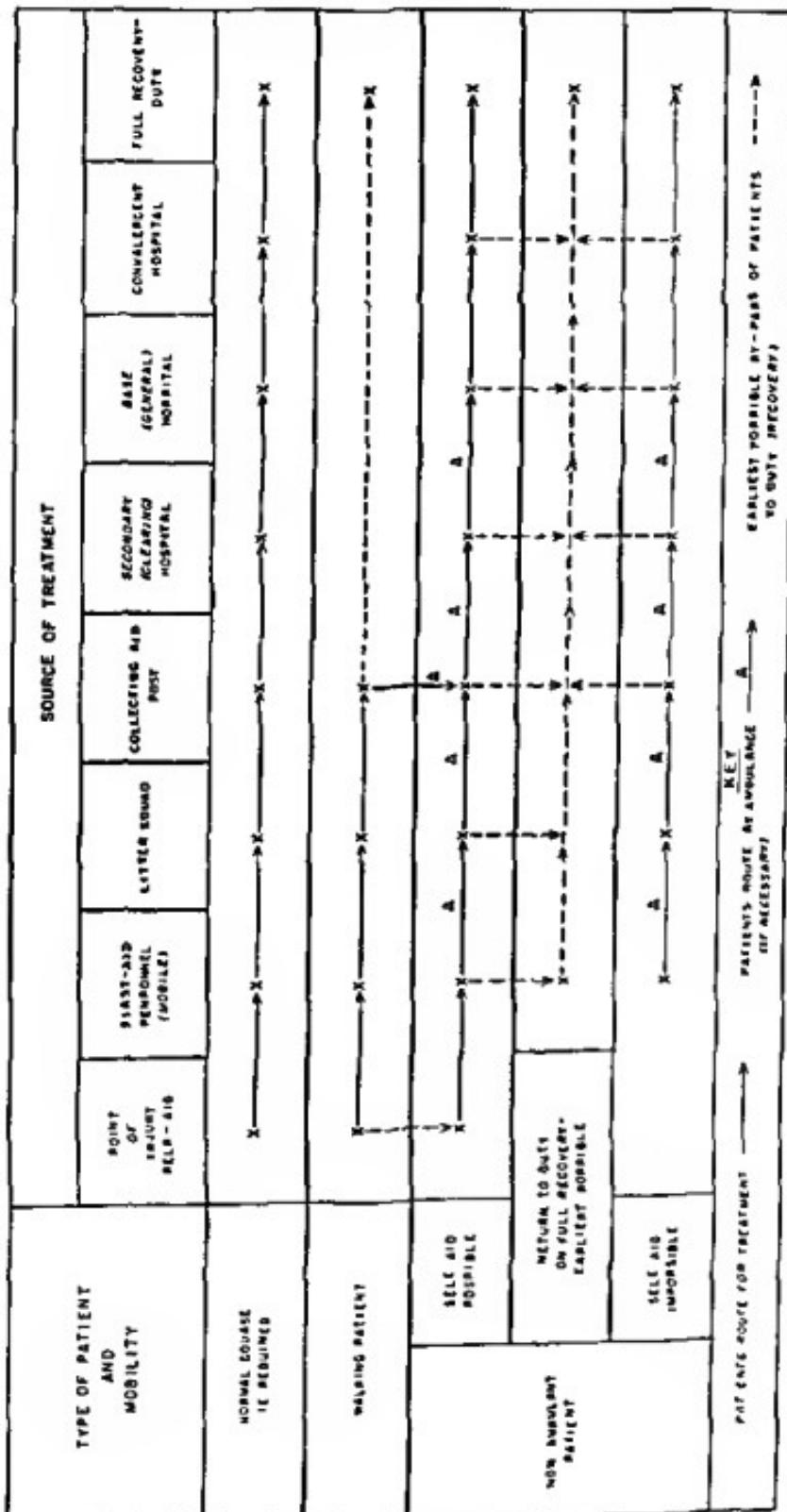


Figure 2.—Sample city. Hospital evacuation of convalescent patients.

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**Figure 3.—Medical plan for civil defense and disaster relief—interim evacuation scheme for railroads (diagrammatic).**

Although many communities would avoid planning for disasters which might never occur, because the vast efforts we have discussed would be deemed needless and wasted if a nation-wide program of civil defense and disaster control were set up and no disaster ever occurred, we should be happy rather than disappointed.



**CHLORAMPHENICOL IN THE TREATMENT OF INFECTIOUS DISEASES,** by  
Joseph E. Smadel, M. D. *American Journal of Medicine* 7: 671-685, Nov. 1949.

Chloramphenicol is one of the important recent additions to the antibiotics of proved clinical value. It is effective against a wide variety of infectious agents, notably the rickettsiae of epidemic typhus, murine typhus, scrub typhus, Rocky Mountain spotted fever, rickettsialpox, and Q fever. Members of the psittacosis-lymphogranuloma venereum group of viruses, which are now classified as rickettsiae, were also considerably inhibited by this antibiotic. Since chloramphenicol is rickettsiostatic rather than rickettsiocidal, suppressive doses must be given long enough for the patient to develop immunity if he is to remain asymptomatic when the drug is discontinued. Chloramphenicol also has an inhibitory effect on the growth of a wide range of bacteria. The gram-negative bacteria predominate. While inhibition of growth of staphylococci and streptococci is obtained, the concentrations required to affect these organisms are far in excess of the effective concentrations of penicillin. High concentrations of the drug in certain culture media reduced the number of *Endamoeba histolytica*. Of greater significance, however, was the observation that large doses of the drug produced an appreciable clearing of infection in rats and dogs with experimental amebiasis.

Resistant variants can be developed from a number of species of bacteria that were originally susceptible to chloramphenicol. No drug-resistant strains of rickettsiae have yet been developed. Chloramphenicol is extremely stable. The drug levels in serum, urine, spinal fluid, milk, and bile can be determined by bio-assay. The chemical method for determining the drug may be used on serum and spinal fluid, but not on urine. Chloramphenicol is a specific therapeutic agent against typhoid fever. Although it is superior to the earlier forms of treatment for brucellosis, aureomycin appears to be equally efficacious. In the treatment of gonorrhea chloramphenicol compared favorably with other methods of therapy but cannot be relied on to suppress a concurrent syphilitic infection.—*Abstract.*



# Streptomycin in the Treatment of Tuberculous Lymphadenitis

John A. C. Gray, Commander (MC) U. S. N.<sup>1</sup>

IN THE large and growing literature on the treatment of tuberculosis with streptomycin, there are few references to the use of the drug in tuberculous lymphadenitis. This is probably due to the fact that scrofula is no longer a common disease. In the seventeenth century King Charles II is said to have administered the "king's touch" to 10,000 cases annually in London (1). Yet in a recent series of 3,998 admissions for tuberculosis to the New York City Municipal Sanatorium, Otisville, N. Y., there were only 19 (0.003 percent) patients with the disease, and in 1945 at Bellevue Hospital, New York, only 5 percent of pediatric tuberculous admissions, and only 20 (0.007 percent) of adult tuberculous admissions had tuberculous lymphadenitis (2). Nevertheless, though uncommon, the disease is of importance to the patient and to the physician, and an assay of the value of streptomycin in its treatment is appropriate.

It is the purpose of this article to present the results of streptomycin treatment in seven cases of tuberculous lymphadenitis showing what the drug did and did not accomplish.

Tuberculous lymphadenitis is a phase of the systemic disease tuberculosis. The classical concept of scrofula is one of cold abscess following cervical lymphadenitis. This was upset in 1826 when Cruveilhier (3) recognized pulmonary tuberculosis as "scrofula of the lungs," and today it is recognized that tuberculous lymphadenitis is inseparable from any manifestation of the disease, be the chief clinical manifestation pulmonary or extrapulmonary. The diagnosis of tuberculous lymphadenitis, therefore, does no more than state that the chief clinical localization is in the lymphatic system. It is recognized that at all times, tuberculosis is a disease involving the entire body, actually or potentially.

When tuberculosis occurs in a lymph node, a portal of entry is necessary. This may be any of the body orifices, including the ocular

<sup>1</sup>U. S. Naval Hospital Portsmouth, Va.

conjunctiva, the skin (3), or the dental roots (1). There the invading tubercle bacillus is phagocytosed by a polymorphonuclear leukocyte, and is transported to a regional lymph node. Poisoned by its engulfed prey, the leukocyte disintegrates, mononuclear cells appear, and tubercle formation begins. The process may remain localized and healing by calcification may occur; or, there may be local spread by direct extension through the lymph node capsule; or, bacilli may be transported via lymphatics to other regional lymph nodes; or, they may find their way into the blood stream and become widely and rapidly disseminated (3).

The pathologic changes in the local serofulous process are divided by Bailey (1) into four stages. In stage 1, there is a caseation within the lymph node; in stage 2, disruption of the lymph node capsule with periadenitis; in stage 3, rupture through the deep cervical or other fascia, with collar button abscess; and in stage 4, perforation of the abscess through the skin with open drainage.

Clinically, the patient first notes swelling in the area of one or more groups of lymph nodes. The onset is seldom acute, and discomfort rather than pain is noted. There may or may not be history of previous similar episodes or of other tuberculous manifestations. Physical examination reveals regional or general lymphadenopathy, with cold abscess or sinus formation, depending on the pathologic stage of the process at the time of examination; there may be slight fever and evidence of coincident tuberculosis; and a complicating disease may be present. In support of the physical findings are a positive tuberculin test, a normal leukocyte count with relative lymphocytosis, and an elevated erythrocyte sedimentation rate. Anemia may be present in debilitated persons. Roentgenograms may reveal old lymph node calcifications in the neck or in other localities. Despite the most careful evaluation of the evidence, biopsy may be necessary to eliminate other lymphadenopathies, such as Hodgkin's disease, Boeck's sarcoid, and lymphopatia venereum. A serological test should be routinely done to rule out the bubo of syphilis.

There are five methods currently employed, alone or in combination, in the treatment of serofilia. These are: rest, heliotherapy, high voltage roentgen therapy, surgery, and streptomycin. Of these, rest, heliotherapy, and roentgen therapy are supportive measures, stimulating the local or general resistance of the body to the tubercle bacillus. Surgery is intended to remove the infected tissue. Streptomycin alone acts directly on the tubercle bacillus, interfering with its normal pathogenic activities (4). One would expect that a measure aimed against the invader would be, if not an exterminative, an incomplete treatment; in fact, such has proved to be the case.

In 1946, Hinshaw, Feldman, and Pfuetze (5) reported fistula closure in 2 of 5 cases of tuberculous lymphadenitis with sinus formation treated with streptomycin. In 1947 the Council on Pharmacy and Chemistry (6) found variable results in "a number" of noncaseating cases. Feldman and Hinshaw (4) reported success in "a high percentage" of cases (total number unstated) where sinus existed. Shameskin et al. (7) had success in 1 of 2 cases without sinus. Flory and others (8) reviewing the results of streptomycin treatment from the point of view of pathologic changes in tissue, found evidence of success in 2 out of 5 cases, none with sinus. Lester (2) using the drug as an adjunct to surgery, reported success in 10 out of 11 patients. Most recently, the Council on Pharmacy and Chemistry (9) found that in 51 patients with draining sinus, 45 improved; and in 36 without sinus, 12 were cured and 18 improved. They concluded that "lymphadenitis responded reasonably well to treatment with streptomycin."

In this hospital we have had opportunity to observe the effects of streptomycin in the treatment of 7 patients with scrofula in the past 18 months. This number of cases is small, but it represents 4.8 percent of the 163 cases of tuberculosis of all forms diagnosed during that period. Also, in a disease now considered rare, it constitutes a considerable number. All the patients were hospitalized and were kept either at bed rest or confined to the ward during treatment. One patient was initially treated elsewhere and came to us in relapse. This man had also received high voltage roentgen therapy. Otherwise, streptomycin and rest were the only therapeutic measures employed. The diagnosis in all cases was established by biopsy. Except where specified, roentgenograms of the chest were negative.

#### CASE REPORTS

**Case 1**—E. F. E., a 24 year-old Filipino, was admitted to the U. S. Naval Hospital, Portsmouth, Va., on 23 September 1947, complaining of a swelling over his right jaw of 3 weeks' duration. Treatment with sulfadiazine and penicillin elsewhere had been ineffective. Physical examination showed enlarged right preauricular and anterior cervical lymph nodes. A tuberculin test (using purified protein derivative, first strength) was strongly positive. Biopsy showed "necrotic lymphoid tissue." He was placed at bed rest and given streptomycin, 10 gm daily to a total dose of 61.5 gm. Several months were allowed for convalescence. He was discharged on 23 July 1948, at which time the nodes were small and hard. On 18 November 1948 he was readmitted because of submental lymphadenitis. Biopsy revealed "a large area of central caseation" in a tuberculous lymph node.

**Comment**—This case was in an early pathologic stage when treated with streptomycin. The most likely portal of entry was the ocular conjunctiva. The disease appeared to be favorably influenced by streptomycin, but the effect was short-lived, and lymphatic extension to another area soon occurred. The treatment with streptomycin must therefore be regarded as a failure.

**Case 2.**—F. G., a 22-year-old white man, was admitted 23 August 1948. He gave a history of drinking raw milk on the farm in childhood. At the age of 10 years, he had swelling in his neck on both sides which "stuck out as far as my ears." These were incised by a physician, and drained pus for several months. He was well until his twenty-first year when, in November 1947, he noted painful lumps in the left side of the neck. He was admitted to another naval hospital, where examination showed a "large swelling" below the left ear, external to the sternocleidomastoid muscle. A roentgenogram of the neck showed old lymph node calcifications. Biopsy showed "acute adenitis" in one node, and "enseous center, fibrous outer edge, minimum lymphoid tissue with heavy calcification" in another, "most probably tuberculous in origin." The tubercle bacillus was demonstrated on smear. He was treated with rest, streptomycin (90 gm. in 90 days), and simultaneous high voltage roentgen therapy (total 732 R units). He was readmitted to this hospital because of local recurrence of glandular swelling. Examination showed a robust young man with slight left anterior cervical lymphadenopathy and threatened sinus formation. There were old surgical scars present in the neck bilaterally. He was treated with bed rest followed by gradual exercise over a period of 6 months. Under symptomatic treatment the lymph nodes became small and hard. By February 1949 return to full active duty was possible.

**Comment.**—This case illustrates the chronicity of serofula and the ability of the tubercle bacillus to lie dormant in lymph nodes for 11 years. It also illustrates the ability of a vigorous youth to combat the disease, (on two occasions) with minimal treatment. Pathologically, it was in stage 3 when first seen here. It must be considered that both streptomycin and high voltage roentgen therapy failed in this case.

**Case 3.**—J. A. J., a 23-year-old Negress, was admitted to the hospital on 16 April 1948. In 1940, at the age of 15, she was found to have pulmonary tuberculosis, and was treated with right pneumothorax. In 1944 the disease was considered to be arrested, and the lung was allowed to reexpand. At the age of 22, in April 1947, she first noted a transient swelling in her neck. This recurred in November 1947, and progressed in size until her admission. Physical examination at that time showed definite enlargement of the cervical lymph nodes in the right anterior and posterior cervical triangles, and a lesser enlargement of the lymph nodes in the left side of the neck. Biopsy was reported to show tuberculous lymphadenitis. Roentgenograms showed no evidence of previous lymphadenitis or of active pulmonary disease. The erythrocyte sedimentation rate was 24. She received streptomycin, 10 gm. daily, for 42 days. There was little immediate response, but 4 months after the termination of treatment, when last seen, the glands were smaller and more firm and the patient was subjectively well.

**Comment.**—This is a case with a pulmonary portal of entry, lymphatic spread to the regional mediastinal lymph nodes, and, after a 7-year period of dormancy, further lymphatic spread to the cervical lymph nodes. Pathologically, it was in stage 2. Streptomycin was probably beneficial, although the ultimate prognosis remains unknown. There is not too much reason for gratification, since she had already experienced a spontaneous remission of the lymphadenitis about 1 year prior to the use of the drug.

**Case 4.**—H. A. Y., a 24-year-old white man, was admitted 19 April 1948 complaining of abdominal pain, bloating, and belching of about 2 week's duration. There was a past history of treatment for "mesenteric lymphadenitis" at the age of 9. Physical examination revealed a temperature of 99.6° F., a tender mass about

2 cm in diameter in the left lower quadrant of the abdomen, and moderate abdominal distention. A tuberculin test was strongly positive. The erythrocyte sedimentation rate was 22. Roentgenograms of the abdomen disclosed a large calcified mass in the mesenteric opposite the fifth lumbar vertebra. A diagnosis of tuberculous mesenteric lymphadenitis was made. Because of threatened intestinal obstruction treatment with a Miller-Abbot tube was necessary, also treatment with streptomycin, 10 gm daily, was begun. Within 1 week the patient was symptom-free and his fever had disappeared. Later the gastrointestinal tract was examined roentgenographically with a barium meal. This showed partial small bowel obstruction. Streptomycin was continued to a total dose of 400 gm. The abdominal mass shrank but did not disappear. On discharge, 12 August 1948, the patient was clinically well.

**Comment**—This case is an example of an intestinal portal of entry, long dormancy, and local recurrence. In all probability, the local periglandular tissues (mesentery and intestinal wall) were involved. Streptomycin apparently obviated surgical intervention for intestinal obstruction, which, in the circumstances, might well have resulted in chronic fistula formation. Even if there is recurrence later, the drug served its purpose at the time.

**Case 5**—L. R., a 24-year-old Negro, was admitted on 27 March 1948. He complained of the loss of 60 pounds of weight in the past 8 months, accompanied by nervousness and sweats. In the 10 days prior to admission he had had fever, chills, swelling of the ankles, and painful lumps in the groin. Physical examination showed an acutely ill man with a temperature of 102° F., pulse 120, and blood pressure 145/70. There was emaciation, exophthalmos, diffuse goiter, swollen legs, tender ankles, and generalized lymphadenopathy. The inguinal lymph nodes were tender. There was slight anemia. The Frei intradermal reaction was positive. A therapeutic test for lymphocytosis venereum with sulfadiazine was unsuccessful. Lymph node biopsy showed tuberculosis. The basal metabolism rate taken in a fever-free interval was plus 51 percent. A diagnosis of simultaneous hyperthyroidism and tuberculous lymphadenitis was established. Streptomycin, 10 gm per day, and propylthiouracil were administered. The total dose of streptomycin was 420 gm. The patient regained 30 pounds of weight, and the lymph nodes became smaller and harder. On 4 August 1948 a subtotal thyroidectomy was performed. (Pathologic diagnosis: Hypertrophic parenchymatous colloid thyroid.) On 15 August 1948 the basal metabolism rate was minus 15 percent. On discharge, 20 August 1948, he was subjectively and objectively well.

**Comment**—In this case of simultaneous hyperthyroidism and tuberculosis of the lymph nodes, the portal of entry of the tubercle bacillus is unknown. Pathologically, the lymphadenitis was in stage I. Streptomycin was probably life-saving, since without it subtotal thyroidectomy would probably have been followed by complications. This is another instance in which, even if there be relapse, the drug was of great value at the time it was used.

**Case 6**—J. G., a 23-year-old Negro, was admitted to the hospital on 13 October 1948 complaining of lumps in the groin. A "crust" had been incised in the right groin 4 months previously, with evagation of pus. Lymph node biopsy showed "hyperplastic, noncaseating tuberculosis." Physical examination showed low grade pyrexia and generalized lymph node enlargement, especially noticeable in the inguinal areas. A roentgenogram of the chest showed extremely enlarged hilar lymph nodes. The second strength purified protein derivative gave a positive reaction. Apart from this and except for the evidence on biopsy, the clinical picture suggested Boeck's sarcoid. Forty-two grams of streptomycin

were administered in 42 days. There was some regression of the surface, but none of the hilar lymph nodes. No follow-up is available.

**Comment.**—The portal of entry in this case is unknown. Spread was probably miliary. Pathologically, the process was in the first stage. The observed effects of streptomycin were minimal.

**Case 7.**—E. B., a 23-year-old white man, was admitted to the hospital on 19 November 1948. As a child, he drank raw milk on the farm. He stated that the herd was tuberculin tested. In July 1948 he noted a lump in the right armpit. On admission, enlarged right axillary lymph nodes were found. On aspiration, pus was encountered. Biopsy showed tuberculous lymphadenitis. A fistula developed at the site where tissue was removed for biopsy. He received 47.0 gm. of streptomycin in as many days. The fistula closed in about 1 month. On 8 April 1949 lymph nodes were normal in size.

**Comment.**—The portal of entry in this case is unknown. The disease progressed rapidly, partly as a result of diagnostic procedures, from pathologic stage 2 to stage 4. Streptomycin apparently arrested the disease, but the follow-up is too short to justify the word "cure."

#### COMMENT

The results from the use of streptomycin in these seven cases of tuberculous lymphadenitis may be summarized as follows: The immediate treatment result was poor in one, and good in six. In two, the drug was unquestionably of great value, regardless of the eventual outcome, since in one it obviated surgery for intestinal obstruction, and in the other it prepared the patient for operation for coincident thyrotoxicosis. On the other hand, in two, in whom a follow-up of 1 year was possible, relapse occurred. This fact renders enthusiasm based on an initial success unwise.

In the two who showed relapse, the recurrent lymphadenopathy subsided over a period of months under treatment with rest and heliotherapy. Since recovery was not uncommon in the pre-streptomycin era with these simple measures, there is reason to doubt the desirability of using this drug in the ordinary case of seroful, the more so since the tubercle bacillus is likely to become resistant to streptomycin, and it may later be ineffective when more urgently needed by the patient.

It will be noted that most of our patients were in an early stage and that fistula formation occurred in only one. This patient responded promptly to the drug. This is in accord with the usual observation that streptomycin is most useful in so-called surgical tuberculosis where drainage exists.

In general, it is probable that streptomycin alone is not a complete treatment for tuberculous lymphadenitis and that it is best reserved for use in the case with fistula or other complication.

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A PRELIMINARY REPORT ON HYPOCERPHALUS, SPINA BIFIDA AND OTHER CONGENITAL ANOMALIES IN THE RAT PARASITED BY TRYPSIN BLUE, by J. Gillman, Christie Gilbert; T. Gillman; and Isobel Spense. *The South African Journal of Medical Science* 13: 47-90, March 1948.

Gillman et al. injected trypan blue into rats. Gross malformations such as ocular defects, spina bifida, tail defects, and hydrocephalus appeared in 19.2 percent of the offspring. If the female rat received an injection before conception as well as an additional dose during pregnancy, 25 percent of the offspring were abnormal. By giving an injection of trypan blue on the seventh day before conception and the seventh day after conception, 80 percent of the litter were abnormal. If only one injection was given on the day before conception 25 percent of the litter were abnormal. A high neonatal mortality, a reduction in the size of the litter, a low birth rate, and a retardation of postnatal development was manifest. They found that trypan blue was bound to the plasma albumin and did not enter the fetus or the amniotic fluid or amniotic epithelium, and that all embryonic tissues except the yolk sac were free. They believe that trypan blue causes anomalies in an offspring by producing such preceding metabolic disturbances as to interfere with the subsequent fetal development -- *Abstract*.



# About the Army Medical Department

## III. Emergency Personnel Planning<sup>1</sup>

PAUL L. ROBINSON, *Colonel, MC, U. S. A.*<sup>2</sup>

A LETTER to the surgeons of major overseas commands concerning the anticipated shortage of medical officers that will occur this summer was quoted in the March issue of the Armed Forces Medical Journal in order that the various steps in planning to meet this particular emergency could be seen.

A few days after this letter was dispatched a meeting was held with the Deputy Chief of Staff, U. S. Army, in which all phases of the problem were discussed. Not the least among the problems to be surmounted in sending a large number of physicians overseas for 3 months were the funds from which their temporary duty travel and per diem could be paid. The Surgeon General was willing to curtail much of the ordinary temporary duty travel of his own personnel in order to meet the emergency. It was considered unfair to prevent officers so assigned from receiving the normal per diem. It was, therefore, decided that per diem would be furnished in accordance with the present regulations, which are determined in each case but in general might be said to be as follows: (a) \$7 a day for the first 30 days, if no quarters are available; (b) \$4 a day if quarters are available; (c) \$4 a day for the second 30 days, if no quarters are available; (d) \$2 a day if quarters are available; (e) \$2 for any period after the second month, if no quarters are available; and (f) no per diem if quarters are available.

The personnel staff officers of all major overseas commands were in Washington at the time of this meeting and the proposition was presented to them, with the inquiry as to whether transportation within the command would be charged against these temporary duty

<sup>1</sup>Continued from the March issue.

<sup>2</sup>Personnel Division, Office of the Surgeon General.

funds. It was universally stated that travel within the command would be by Government transportation. The personnel representatives also stated that bachelor officers' quarters would be furnished to every officer. These two facts lowered the amount of temporary duty funds required to the point that they could be met by the Department of the Army. The officers from the various commands were asked if careful planning could be accomplished within the command to assure no waste of time, in order that each officer sent on temporary duty could be used to the fullest extent. All stated that this planning would be accomplished.

Thus, it was determined that no more than 100 residents would be used on this temporary duty. The Navy was unable to loan the Army any physicians who were on active duty but was willing to ask for Reserve medical officers to come on duty for this period if the Army so desired. The Army also considered whether or not it was feasible to ask Reserve medical officers to come on duty for this period. It was determined that only sufficient funds were available to send the 100 residents previously mentioned. In view of the emergency nature of this problem and the administrative difficulties involved in ordering Reserve officers to active duty, it was not considered practicable to use such personnel. It was further decided that the number of medical officers on duty in the Army areas could not be reduced, even temporarily, without endangering military preparedness. The use of civilian physicians in overseas commands was not practicable because their allowances would have to come from funds which are extremely limited.

The next step was to send a letter to the hospitals with their quotas by military occupational specialty number. The situation was carefully explained so that everyone in the teaching hospitals would be thoroughly cognizant of the nature of the emergency. Each of the hospitals was asked to supply the Personnel Division of the Surgeon General's Office with the names of the officers selected to fill the various quotas. The same proportion of residents was taken from each of the hospitals—with due allowance for programs in which there was only one resident. Each hospital was notified that the selected officers would be authorized per diem and that air transportation would be furnished from the United States to the command. They were also told that dependents could not accompany the officers for this period of duty. Only first- and second-year residents were selected because it was to everyone's advantage to allow the senior residents to finish their program and thus become available for regular duty on 1 July. Everyone was notified that those used in this emergency would go back into the training program for the completion of their

current year of training, even though it extended their time in the hospitals.

This program was received with reasonable enthusiasm by the residents themselves. In only a few instances was it necessary for the hospital commanders to make the selection since the quota was largely filled by volunteers. This plan has the advantage of allowing these residents to visit remote places for a short time, in addition to rendering a distinct service to their country.

The overseas commands, while not satisfied with the number of medical officers being furnished indicated that they were satisfied with the efforts we were making to assist them in this period. Much of the elective medical and surgical work that would ordinarily be done during these months will have to be curtailed.

Since the Air Force also has residents in the Army teaching hospitals, the Surgeon General of the Air Force was advised of our plan and the policy was established that should any of the officers selected to fill this quota transfer to the Air Force, orders would be issued for these officers to complete the emergency mission.

The surgeon of one of the overseas commands stated that he would like it explained to all officers that the bachelor quarters available are not luxurious; and opportunities for travel on pass or leave will be almost impossible during the period when the officers are on temporary duty. He strongly urged that wives do not visit their husbands while they are overseas because hotel or other living accommodations could not be provided for them and their expenses would be high. Aside from these considerations everything will be done to make the tour of temporary duty both pleasant and profitable.

In addition to these emergency measures concurrent planning for permanent assignments is proceeding normally. About 260 medical officers on Reserve status have been sent a questionnaire in which they were asked to state their preference for assignments, their present family situation, and other pertinent information that would be useful in determining their assignment. Fourteen have already indicated their preference for a Regular Army career and have applied for a Regular Army commission. Selections will be made from this group for a few openings in the newly established courses in military medicine to be given this fall and winter at the Army Medical Center, Washington, D. C., and the Army Medical Center, Fort Sam Houston, Tex.

The overseas commands have preference on the remainder of the available officers. The combined requirements for officers having the qualifications of this group are 211. The number available falls short of the goal by 18 percent. A numerical goal, by command, was therefore established to fill 82 percent of the requirements for each of the

overseas commands. Requirements for the Far East Command can never be met from first choices; whereas, the opposite is true of the European Command. Because there are many locations in the Far East Command where living conditions are not suited to family life, single officers were placed on the Far East list. There were still 23 officers to be selected and this selection was made from married officers who did not have children and from officers who contemplated marriage before the date of their shipment.

Selections of a few officers had to be made for the smaller commands such as Trieste and Alaska. To meet the quota for Trieste, a single officer was selected who had made a special plea for assignment to the European Command because of the Holy Year, since he was a Catholic. Further justification for the selection of a single officer for this assignment was a recent directive regarding nonshipment of dependents to Trieste because of the generally poor housing accommodations. The quota for Alaska was two officers. After carefully screening those available one officer from northern Wisconsin and one from North Dakota were selected; one was married and had no children; the other was single. These two officers were selected because of the probability that they would enjoy an assignment in a cold climate better than officers who had not been accustomed to Northern climates.

The list was then reviewed for officers to fill the quota of 16 for the Caribbean Command. Quarters are generally available for married personnel in the Caribbean Command and only married officers with dependents were selected for this assignment. Another criterion that was used was nearness to the port of embarkation in order that the maximum amount of travel funds could be conserved. Of the remaining group, two officers had indicated a preference for Hawaii. These two were selected to meet the quota of 16, the rest being selected from married officers who had named the Caribbean Command as first or second choice, but were closer to San Francisco than to the east coast.

United States

These selections left a group who had all given the European Command as first choice. All were married, although not all of them had children. To meet a quota of 5 for Austria, 4 were selected alphabetically from the top of the list. One single officer was selected for assignment to Austria because of his ability to speak Czechoslovak. Nine officers from this group have indicated that they expect to have children born this summer. All of them have been temporarily assigned as near to their homes as possible, and their shipment to overseas stations has been deferred until after 1 January 1951. These are

a few examples of our attempts to individualize assignments insofar as possible. The Personnel Division is striving to improve its career assignments as they pertain to the use of personnel, and is always glad to discuss with any officer the reasoning that has gone into his particular assignment.



**CAUSES FOR AMPUTATIONS PERFORMED AT WALTER REED GENERAL HOSPITAL DURING 1947 AND 1948,** by August W. Spittler, *Colonel, MC, U. S. A.*; and Lloyd W. Taylor, *Lieutenant Colonel, MC, U. S. A.* *Journal of Bone and Joint Surgery* 31A: 800-804, Oct. 1949.

Although no amputations were performed for osteomyelitis alone, this disease still takes first place as a major contributing cause of amputation. Except for apparent systemic benefit to a patient during acute flare-ups of osteomyelitis, sulfonamides and antibiotics have contributed little to the cure of adult patients with chronic draining osteomyelitis. In planning a reconstructive program of rehabilitation on an injured extremity, the percent of successful end results is in inverse ratio to the number of operations required to produce that result.

The authors conclude that: (a) Unilateral amputation is not a contra-indication to amputation of the contralateral extremity; (b) skin grafting of any type to full weight-bearing surfaces is so highly unsatisfactory as to condemn the procedure; (c) elective sacrifice of the fibula in a reconstructive program is highly unsatisfactory; (d) a Syme's amputation is the best major amputation through an extremity; (e) when amputation is a possibility, surgical incisions should be placed in such a manner as to insure amputation at the lowest possible level should this procedure later become necessary; (f) when amputation is a possibility, the removal of cancellous graft from the ilium should be accomplished on the affected and not on the contralateral side; and (g) needless operative procedures that promised little possibility of success were performed on many of the patients studied, causing prolonged months of hospitalization, psychic trauma, and generalized systemic damage, secondary to prolonged periods of chronic infection. Early evaluation of these cases, and applying sound surgical principles could have prevented many of these undesirable results. The principle most often disregarded in these cases was that amputation is a sound method of treatment and not a last resort.—*Abstract.*



THE PHYSICIAN MUST KNOW  
WHAT HIS PREDECESSORS HAVE  
KNOWN IF HE DOES NOT WISH  
TO DECEIVE BOTH HIMSELF AND  
OTHERS—*Hippocrates*

## EDITORIAL

### The Periodic Physical Examination

The primary function of the physician is to recognize disease in its earliest phase in the asymptomatic person. This must be a fundamental concept in the practice of medicine if the physician is to avoid the dilemma of recognizing a disease when its symptoms and signs are pathognomonic and evidence of advanced pathologic changes—it is then too late for early and effective treatment.

Except in the fulminating types of organic diseases and the acute infections, a period of a year or two exists between the time of the appearance of early pathologic tissue changes and pathognomonic signs and symptoms. It is in this interval, and particularly during the early phases of the pathologic process, when the diagnosis must be made. The symptoms then are apt to be vague and of a minor nature, and thus may be misleading, or the patient may be asymptomatic. However, upon examination, clinical and laboratory evidence of disease can often be detected.

Examples of this period of latency are the following: (a) When malignant tissue remains after surgical resection, the interval between surgical removal of the cancer and the recurrence is about 15 to 20 months, or longer. If this is the latency period when cancer is already present, then the interval between the time of earliest tissue invasion and the time of appearance of the textbook description of a chronic organic disease or a malignant lesion probably is much longer. In the interval the patient may have been asymptomatic or else symptoms of a vague or minor nature may have been present. (b) The normal kidney can excrete urine of a specific gravity of 1022 or higher; if the kidney cannot excrete urine of a specific gravity higher than 1020 there exists moderate glomerular and tubular injury. When the kidney cannot excrete urine of specific gravity over 1010 it has undergone extensive glomerular and tubular damage, and extensive fibrosis. During this period of progressive pathologic changes, the patient probably remained asymptomatic until the symptoms of glomerulonephritis, such as dependent edema, dyspnea, and headache, appeared.

(c) In arteriolar nephrosclerosis, mild renal damage may exist and yet there may be no alteration in the chemistry of the urine because the minimal increase in blood pressure was sufficient to supply the glomeruli and the tubules with the necessary amount of blood under adequate pressure and, therefore, glomerular filtration remained normal. When albuminuria, cylindruria, hypertension, and edema appear the pathologic renal changes are then already far advanced. (d) Sir Thomas Lewis observed that if the total capacity of the healthy heart for work is taken at 10 units, only one unit is required to maintain a normal circulation while the body is at rest; the remaining 9 form the reserve. He points out that, in cardiac failure, by the time congestion sets in, nine-tenths of the heart's capacity to perform its task have been lost. In this interval the only symptoms indicative of cardiac disease may have been breathlessness occurring after some act previously performed without undue breathlessness, or the occurrence of vague precordial discomfort or palpitation.

There are many chronic diseases in which the detection of an organic or neoplastic lesion in an asymptomatic person lies within the capabilities of the physician, provided periodic physical examinations are done and provided clinical acumen is correlated with every means of diagnosis ordinarily available. To do this requires (a) an evaluation of a thorough, detailed, clinical history paying particular attention to vague or what appear to be minor complaints. Often a careful interrogation will be required to elicit symptoms which the patient may not otherwise volunteer. (b) The examiner must seek evidence of the presence of organic changes rather than physical defects which reflect changes in function incident to age and which do not affect health. The thorough physical examination, in addition to percussion, auscultation, and palpation, must include an inspection of every visible organ and tissue—the larynx, as well as the cervix, rectum, and the sigmoid; palpation of the breast, digital examination of the rectum in the knee-chest position (4 out of 5 rectal carcinomas are within the reach of the examining finger), and of the prostate always must be done; and a sigmoidoscopic examination is necessary to detect malignant changes anywhere below the middle third of the sigmoid.

To imply that a negative result obtained after percussion and auscultation of the lungs of the asymptomatic person is indicative of the absence of organic or neoplastic lesion of the lung, jeopardizes the physical welfare of the person examined. A roentgenogram of the lungs must be made on a 14×17-inch film if a peripheral organic or neoplastic lung lesion is to be discovered at the earliest possible moment. A roentgenologic study of the stomach and the gastrointestinal tract must be done whenever there is a family history of gastric carcinoma. A hemoglobin determination and red and white blood cell

counts are required to detect disease of the hemopoietic system; and the entire quantity of urine excreted during a period of 24 hours must be examined, for it is not possible to estimate the function of all the glomeruli and the tubules if only a single specimen of urine is examined. An electrocardiogram and other clinical and laboratory examinations including the method of cytologic diagnosis of Papam-colaon, will be required, depending upon the evaluation of clinical history and physical findings.

If a disease is to be arrested or cured early, the diagnosis must be made in the interval between the occurrence of the early pathologic tissue changes and the appearance of pathognomonic signs and symptoms. This is the challenge that the physician must meet if progress in the methods of clinical diagnosis is to keep pace with the recent advances in biochemistry, surgical technique, and therapeutics.

—J. L. S

## BOOK REVIEWS AND BOOKS RECEIVED



Publishers submitting books for review are requested to address them as follows:

The Editor,

UNITED STATES ARMED FORCES MEDICAL JOURNAL,

Bureau of Medicine and Surgery, Navy Department,  
Washington 25, D. C.

(For review)

**OPERATIVE TECHNIC IN SPECIALTY SURGERY**, edited by Warren H. Cole, M. D., F. A. C. S., Professor and Head of the Department of Surgery, University of Illinois College of Medicine, Director of Surgical Service, Illinois Research and Educational Hospitals, Chicago. Introduction by Allen O. Whipple, M. D., F. A. C. S. 725 pages, Illustrated. Appleton-Century-Crofts, Inc., New York, N. Y., publishers, 1949. Price \$14.

This book is made up of a composite group of chapters, each devoted to a different branch of surgery. Each is written by a different author who is well-known as an outstanding authority in his field. The book contains much information of interest to the student and specialist but will be of most interest to the general surgeon whose work is more or less involved with most of the surgical specialties. There are no chapters dealing with ophthalmology or otolaryngology. The book is not an atlas nor is it a reference library, but it is a useful adjunct to a surgeon's library as it contains much condensed practical and up-to-date information on operative therapeutics.

The opening chapter deals with plastic surgery in which the general principles are stressed more than specific details of individual operations. However, some of the procedures are illustrated by multiple-stage illustrations. Following this is a chapter on thoracic surgery and repair of diaphragmatic hernias. The operative procedures for various thoracic lesions are described except for the heart, which, together with the mediastinum, is covered in the chapter that follows. The latter is particularly interesting in its description of how to repair penetrating wounds of the heart and how to recognize cardiac compression. Following this there are several chapters devoted to orthopedic surgery beginning with the operative therapy of fractures, then one about osteomyelitis, followed by one on deformities and neoplasms of bone, proceeding to a chapter which deals with operative approaches to joints and containing some excellent illustrations, followed by a final chapter which discusses the surgical procedures used to help correct the deformities caused by spastic paralysis and anterior poliomyelitis.

The next five chapters deal with surgery in relation to the various parts of the nervous system and its coverings. The first of these involves the general principle of closure of scalp wounds, the method for preparing a flap in different areas of the scalp and closure of defects, and finally the method of dealing with various brain lesions. Next is a chapter devoted to the surgical problems which

can be performed on them. A chapter dealing with the peripheral nerves contains a number of good illustrations showing the proper approaches, and the disfiguring scars resulting from poorly planned approaches. The materials used in repair and the technique of suturing nerve trunks are discussed and illustrated. The last chapter on the nervous system concerns the various types of sympathectomy together with the technique of performing these operations as well as the method used to perform a lumbar and thoracic paravertebral sympathetic block.

In a chapter on gynecological surgery the author describes a method for performing all the usual types of pelvic surgery and gives the indications, together with the advantages and disadvantages to be considered. A more lengthy discussion of the procedure used in radical hysterectomy for cervical cancer, and that for radical groin dissection in cancer is included.

The final chapter is devoted to the male genito-urinary system and following a short opening discussion of anatomical considerations, symptoms, and methods of diagnosis, the author discusses the operations performed in that region.

In conclusion it may be stated that this is an up-to-date treatise written by a group of America's leading surgical specialists. The discussions are short and to the point and written so that the directions are readily followed. A bibliography is included at the end of each chapter. It is an excellent book for the practicing surgeon who wishes to learn what an excellent authority does without searching through lengthy volumes.—Commander C. D. Burroughs, (MC) U. S. N.

**ORGANIC CHEMISTRY IN PHARMACY,** edited by Charles O. Wilson, Ph. D. Professor of Pharmaceutical Chemistry Chairman of the Department of Pharmaceutical Chemistry, University of Wisconsin, Milwaukee, Wis., and Edward Ph. D. Professor of Pharmaceutical Chemistry, University of Wisconsin, Milwaukee, Wis. 622 pages Illus. \$4.00 Price \$4.

With the assistance of a staff of experts, the authors have produced an up-to-the-minute text that should be welcomed by teachers, students, and professional pharmacists.

The book has as its stated objective the presentation of the essential pharmaceutical knowledge of the organic chemical substances used in pharmacy and medicine. As a text, it is designed for a course in organic pharmaceutical chemistry based upon a general course in organic chemistry and preceding courses in pharmacology. To fit into this position in the curriculum, each chapter is opened with a review of the basic principles of the class and to orient the student in the relationship between chemical structure and pharmaceutical uses, chapters are included on physical properties in relation to biologic action and metabolic changes of drugs and related organic compounds in the body. In addition, brief references are made to pharmacologic action in the discussion of individual compounds.

Compounds are presented in the order of chemical constitution as aliphatic, aromatic, heterocyclic, and other cyclic types, with special chapters on sulfur compounds, compounds containing heavy metals, dyes, surface-active agents, alkaloids, antihistamines, vitamins and proteins, and amino acids. Working formulas are given where feasible and all important structural formulas have been incorporated in the text. In areas of active research, the authors look forward with the inclusion of many compounds which are still in the laboratory stage of development.

In striking contrast to most organic chemistry books, this one is scientifically accurate and at the same time is pleasantly readable. It is well indexed, and

many original source references are given. It is well arranged and excellently printed. *Organic Chemistry in Pharmacy* will be well received and will be a valued addition to the literature of pharmacy.—Commander W. P. Briggs, (MSC) U. S. N.

## BOOKS RECEIVED

Receipt of the following books is acknowledged. As far as practicable, these will be reviewed at a later date.

**NEUROLOGIST**, by Roy R. Grinker, M. D., Director of the Institute for Psychosomatic and Psychiatric Research and Training and Chairman, The Department of Neuro-psychiatry of the Michael Reese Hospital, Chicago, Ill., and Paul C. Bucy, M. D., Professor of Neurology and Neurological Surgery, University of Illinois College of Medicine, Chicago, Ill. 4th edition, completely revised and reset in new type. 1134 pages, illustrated. Charles C. Thomas, Springfield, Ill., publishers, 1949. Price \$12.50

**THE PRACTICE OF REFRACTION**, by Sir Stewart Duke-Elder, K. C. V. O., M. A., D. Sc. (St. And.), Ph. D. (Lond.), M. D., F. R. C. S., Hon. D. S. C. (North Western), Surgeon-Oculist to H. M. The King, Knight of Grace of the Order of St. John; Consulting Ophthalmic Surgeon to the Army and the Royal Air Force, Director of Research, Institute of Ophthalmology, University of London, Consulting Ophthalmic Surgeon, Moorfields Westminster and Central Eye Hospital; Ophthalmic Surgeon, St. George's Hospital. 5th edition. 317 pages, with 216 illustrations. The C. V. Mosby Co., St. Louis, Mo., publishers, 1949. Price \$6.25

**HUMAN HELMINTHOLOGY**, A Manual for Physicians, Sanitarians, and Medical Zoologists, by Ernest Carroll Faust, A. B., M. A., Ph. D., The William Vincent Professor of Tropical Diseases and Hygiene, Head of the Division of Parasitology, Department of Tropical Medicine and Public Health, The Tulane University of Louisiana, New Orleans, La. 3d edition, revised. 744 pages, illustrated. Lea & Febiger, Philadelphia, Pa., publishers, 1949. Price \$10.

**ROENTGEN DIAGNOSIS OF THE EXTREMITIES AND SPINE** (Annals of Roentgenology, Vol. XVII), by Albert B. Ferguson, M. D. 2d edition, revised and enlarged. 519 pages, illustrated. Paul B. Hoeber Inc., New York, N. Y., publishers, 1949. Price \$15.

**HEMATOLOGY FOR STUDENTS AND PRACTITIONERS**, by Willie M. Fowler, M. D., Professor of Internal Medicine, University of Iowa, Iowa City, Ia., with a chapter by Elmer L. DeGowin, M. D., Associate Professor of Internal Medicine, University of Iowa, Iowa City, Ia. 2d edition, revised. 535 pages, illustrated. Paul B. Hoeber, Inc., New York, N. Y., publishers, 1949. Price \$8.50

**MALIGNANT DISEASE AND ITS TREATMENT BY RADIUM**, by Sir Stanford Cade, K. B. E., C. B., F. R. C. S., M. R. C. P., Surgeon, Westminster Hospital, Mount Vernon Hospital and Barium Institute, Lecturer in Surgery, Westminster Hospital Medical School and formerly Examiner in Surgery, University of London; Member of the Court of Examiners, late Hunterian Professor and Arris and Gale Lecturer, Royal College of Surgeons of England; Member of the National Radium Commission and Trust. Consultant in Surgery to the Royal Air Force, with a Foreword by Sir Ernest Rock Carling, F. R. C. P., F. R. C. S., F. F. R., Consulting Surgeon and Vice-President, Westminster Hospital. Volume II, 2d edition. 430 pages, illustrated. The Williams & Wilkins Co., Baltimore, Md., publishers, 1949. Price \$12.50

**TEXTBOOK OF MEDICINE**, edited by Sir John Conybeare, K. B. E., M. C., D. M. (Oxon), F. R. C. P., Physician to Guy's Hospital, London. 9th edition. 875 pages, illustrated. The Williams & Wilkins Co., Baltimore, Md., publishers, 1949. Price \$8.

**HELP YOURSELF TO BETTER SIGHT**, by Margaret Darst Corbett. 218 pages. Prentice-Hall, Inc., New York, N. Y., publishers, 1949. Price \$2.50.

**OPERATIONS OF GENERAL SURGERY**, by Thomas G. Orr, M. D., Professor of Surgery, University of Kansas School of Medicine, Kansas City, Kans. 2d edition. 890 pages with 1,700 step-by-step illustrations on 721 figures. W. B. Saunders Co., Philadelphia, Pa., publishers, 1949. Price \$13.50.

**MATERIAL OF MEDICAL EMERGENCIES** by Stuart C. Cullen, M. D., Professor of Surgery, Chairman, Division of Anesthesiology, State University of Iowa College of Medicine and E. G. Gross, M. D., Professor and Head of Department of Pharmacology, State University of Iowa College of Medicine. 267 pages, Illustrated. Year Book Publishers, Inc., Chicago, Ill., publishers. 1949. Price \$3.75.

**FEMALE SEX ENDOCRINOLOGY, CONINE THERAPY** by Charles H. Blumberg M.D., Associate Obstetrician, Chief of Female Sex Endocrinology and Fetalistic Laboratory, Jewish Hospital of Brooklyn. 133 pages, 30 illustrations including 3 in color. J. B. Lippincott Co., Philadelphia, Pa., publishers. 1949. Price \$4.

KAYE, PAGE AND O'SHAWA-VASSETT'S PULMONARY TRACHEOLOGIC Pathology Diagnosis Management and Prevention revised and partly rewritten by Walter Engel M.D., Pathologist, Central Middlesex County Hospital London F. A. H. Simmonds, M.A. M.D. D.P.H. Medical Director, Clare Hall County Hospital Middlesex N. McDonald, M.B. M.L.C.P. F.R. Physician in the Chest Clare Redhill County Hospital Middlesex, L. Paul F. K. C. S. Thoracic Surgeon Hillingdon County Hospital and Harefield County Hospital, Middlesex 2d edition 120 pages Illustrated Geoffrey Cumberlege Oxford University Press, New York, N.Y. publishers, 1949 Price \$15.50

**EPILEPSY AND CONVULSIVE DISORDERS IN CHILDREN.** by Edward M. Bridge M.D. Research Professor of Pediatrics School of Medicine University of Buffalo Director of Research Children's Hospital of Buffalo formerly Associate in Pediatrics Johns Hopkins School of Medicine, and Physician in Charge, Johns Hopkins Epilepsy Clinic. 670 pages, illustrated. McGraw-Hill Book Co. Inc., New York, N.Y. publishers, 1949. Price \$8.50

**STOMACH DISEASE AS DIAGNOSED BY GASTRO-SCOPY** by Eddy D Palmer A.B. M.S. M.D.  
Major, Medical Corps, United States Army. Formerly Chief Gastrointestinal Section, Walter Reed General Hospital, Washington, D.C. 200 pages, 53 black and white illustrations and 56 in color by Charles Anderson. Lea & Febiger, Philadelphia, Pa., publishers, 1949. Price \$5.50.

*DENTISTRY IN PUBLIC HEALTH* edited by Walter J. Pelton, B. S., D. D. S., M. B. F. D.,  
Dental Surgeon, C. S. Public Health Service, Colorado and Jacob M. Wiesen, D. D. S.,  
M. B. F. D., Director Joseph Samuels Dental Clinic, Rhode Island State Hospital,  
for the Dental Health section of the American Public Health Association, 263  
pages, Illustrated with 61 figures. The W. B. Saunders Co., Philadelphia, Pa.  
Publishers, 1949. Price \$5.50.

POLYOMYELITIS. Papers and Discussions Presented at the First International Poliomyelitis Conference, compiled and edited for the International Poliomyelitis Congress, 300 pages illustrated J. B. Lippincott Company, Philadelphia Pa. publishers, 1949 Price \$5.

1948 YEAR BOOK OF NEUROLOGY, PSYCHIATRY AND NEUROPSYCHIATRY. Neurology edited by Elton H. Beeson, M.D., Professor of Neurology and Psychiatry, University of Wisconsin Medical School; and Melvin G. Masten, M.D., Associate Professor of Neuropsychiatry, University of Wisconsin Medical School. Psychiatry edited by Nolan D. C. Lewis, M.D., Director, New York State Psychiatric Institute and Hospitals. Professors of Psychiatry, Columbia University. Neuro-surgery edited by Percival Bailey, M.D., Professor of Neurology and Neurological Surgery, University of Illinois. The Year Book Publishers, Inc., Chicago, Ill., publishers, 1949. Price \$5.

*Obesity* by Edward H. Bynearson, M.D., F.A.C.P. Division of Medicine, Mayo Clinic, Rochester, Minnesota; and Clifford E. Gotsleib, M.D., Mayo Clinic, Rochester, Minnesota. Edited by Willard O. Chatzlos, Professor of Clinical Medicine, Mayo Clinic, Rochester, Minnesota. 134 pages. \$3.50.

HISTOLOGY AND HISTOPATHOLOGY OF THE EYE AND ITS ADVENTS by J. G. Sommers M.D., Assistant Professor of Ophthalmology, College Medical Examiners, Medical Officer, U.S. Public Health Service Los Angeles Calif. 1940 pages, Illustrated. Grune & Stratton New York, N.Y. publishers 1949 Price \$12



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X-ray room, ward, and operating room  
of an Armed Forces Medical Dispensary

## Foreword

The UNITED STATES ARMED FORCES MEDICAL JOURNAL represents the unification of the BULLETIN OF THE UNITED STATES ARMY MEDICAL DEPARTMENT, published since 1922, and the UNITED STATES NAVAL MEDICAL BULLETIN, published since 1907. This joint periodical is the medium for disseminating information of administrative and professional interest to all medical personnel of the Department of Defense.

It is the aim to include in each issue administrative directives, original scientific and professional articles, editorial comments on current professional literature of special interest, clinical notes, descriptions of new devices and instruments, abstracts of articles from various medical periodicals, and notices and reviews of newly published professional books, of interest to all commissioned medical personnel of the Department of Defense.

The Director, Medical Services, and the Surgeons General of the several services extend an invitation to all medical officers, dental officers, Medical Service Corps officers, Nurse Corps officers, officers of the Veterinary Corps, all officers of the ancillary services of the medical services of the Armed Forces, and to the medical consultants of the Army, Navy, and Air Force to submit manuscripts for publication in this JOURNAL.

RICHARD L. MEILINO, M. D.,  
*Director, Medical Services,*  
*Department of Defense.*

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*Major General, U. S. A.,*  
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*Rear Admiral (MC) U. S. N.,*  
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UNITED STATES  
GOVERNMENT PRINTING OFFICE  
WASHINGTON : 1950

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Yearly subscription, \$4; foreign subscription, \$5.35

Single number, 35 cents.

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**JOSEPH L. SCHWARTZ, Editor in Chief**

Captain, Medical Corps,  
United States Navy

**WAYNE G. BRANDSTADT, Associate Editor,**

Lieutenant Colonel, Medical Corps,  
United States Army

**ALBERT A. GENTILECORE, Associate Editor,**

Captain, Medical Service Corps,  
United States Air Force.

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## Announcement

The Director of Medical Services, Department of Defense, and the Surgeons General of the Army, Navy, and Air Force are sponsoring a session on Military Medicine and Surgery at the American Medical Association meeting in San Francisco. The session will be held the mornings of 28-29 June under the section on Miscellaneous Topics. The program will be presented by nationally outstanding civilian and military scientists who will cover professional problems of military medicine and surgery which will greatly interest all physicians concerned about national defense. The chairman of the session is Dr. Wendell G. Scott, of St. Louis, with Dr. A. Randolph Lovelace, of Albuquerque, as vice chairman and Col. William S. Stone of the U. S. Army Medical Corps as secretary. All medical officers and other physicians interested in civil or other phases of national defense are urged to attend.

The tentative program of this session is printed on the inside of the back cover of this issue.



OFFICE OF THE SECRETARY OF DEFENSE,  
WASHINGTON 25, D. C.

MEMO. Personnel of the Medical Services, the United States Armed Forces

Many military leaders in the field of hospital management have felt that various improvements developed in outstanding hospitals in the private industry, could be applied profitably to military hospital management, both as a means of permitting the physician to give more and better care and to meet the problem of steadily mounting hospital costs.

More than a year ago, the U. S. Army Medical Department, with the cooperation and coordination of many other staff agencies of the Department of Army, pioneered a research program to modernize hospital management methods. After study, a carefully conceived pilot program was set up in a selected Army hospital incorporating the most modern principles and the best thinking of the outstanding hospitals and operating staffs of the Army, Navy and Air Force.

This pilot project was very much successful.

There has been established in the Office of Medical Services, with the concurrence of the three Surgeons General, a pilot group which is mapping plans for use of these improved hospital management methods in the programs of the three military services.

*Richard L. Murphy*  
Richard L. Murphy, M.D.  
Director of Medical Services

# UNITED STATES ARMED FORCES MEDICAL JOURNAL

Published monthly by the Department of Defense

JOSEPH L. SCHWARTZ, *Captain (MC), U.S.N.*, Editor in Chief  
WAYNE G. BRANDSTADT, *Lieutenant Colonel MC, U.S.A.*, Associate Editor  
ALFRED A. GENTILCORE, *U.S.A.F. (MSc)*, Associate Editor



THE PRINTING OF THIS PUBLICATION HAS BEEN APPROVED BY THE DIRECTOR OF THE BUREAU OF THE BUDGET, OCTOBER 19, 1949

## Atabrine in the Treatment of Cardiac Arrhythmias

CHARLES H. EATON, *Lieutenant Commander (MC) U.S.N.<sup>1</sup>*  
ROBERT L. HILL, *Lieutenant, junior grade (MC) U.S.N.<sup>1</sup>*

**A**TABRINE can be used as a substitute for quinidine to convert atricular fibrillation and other abnormal cardiac rhythms to a normal sinus mechanism (*1*).

Chemically unrelated compounds often possess similar pharmacologic actions. For example, the antimalarial activities of quinine and atabrine (quinacrine hydrochloride) are well known, but they are unrelated chemically.

Similarly quinidine, an optical isomer of quinine, and atabrine have many similar physiological actions: both inhibit cholinesterase from the electric organ of *Electrophorus electricus* (*2*), dilate coronary vessels in perfused rabbit hearts (*3*), inhibit vagus-stimulated gastric secretion (*4*), increase the refractory period and decrease the excitability of perfused rabbit (*5*) and frog hearts (*6*), and paralyze vagus-inhibitory fibers to the dog's heart (*1*) (*7*).

<sup>1</sup>U.S. Naval Hospital, Long Beach, Calif.

Quinidine has been used for many years to restore auricular fibrillation and other cardiac arrhythmias to regular sinus rhythm. Its actions include lengthening the refractory period and decreasing the rate of conduction in the auricular muscle, decreasing the vagus inhibitory effect on the atricle, and depressing atrioventricular conduction. These actions combine to abolish the "circens" movement, and allow the sino-auricular node to again assume the role of pacemaker (8) (9).

Experimentally in dogs atabrine has been shown to restore normal sinus rhythm in auricular fibrillation as effectively as quinidine (10). Atabrine was also effective in restoring normal sinus rhythm in supraventricular tachycardias (1) (11) (12).

The toxic actions of atabrine include liver intoxication (13), skin discoloration (14) (15), dermatitis (16) (17) (18), aplastic anemia (17), central nervous system damage (19) (20), psychoses (15) (21), and gastrointestinal disturbances (22). However, these adverse effects occur in only a small number of persons taking atabrine and are of short duration; the only prolonged disturbance is the dermatitis (16) (18). Electrocardiographic changes have occurred in only a few patients (8) (23). It has been suggested that intravenous atabrine was toxic to perfused rat's or rabbit's heart. However, such solutions are strongly acid ( $pH$  4.9), and solutions of the same  $pH$  not containing atabrine produced the same effect (24). Furthermore, the small volume of fluid injected (10 cc.) when diluted by blood would scarcely alter the  $pH$  of the blood.

Because of the possible toxic manifestations from prolonged use of atabrine, we limited the dosage of atabrine to a maximum of three separate intramuscular (gluteal) injections of 0.4 gm each, dissolved in 10 cc. of 1 percent novocain solution (or 0.2 gm. intravenously in 10 cc. of normal saline), given every 6 hours (1) (11) (12). (Atabrine dihydrochloride is available in 0.2 gm. ampules.) With such methods relatively rapid high blood levels of atabrine are obtained. If normal sinus rhythm was restored prior to the second or third doses, the latter were omitted.

The following groups of patients were considered suitable candidates for atabrine therapy: (a) those with auricular fibrillation established less than 1 month regardless of associated valvular or non-valvular heart disease; (b) those with "established" auricular fibrillation in whom some indication for conversion to a sinus rhythm, such as embolism or chronic failure, existed; (c) auricular flutter; (d) paroxysmal tachycardias; and (e) ectopic rhythms associated

it was our plan to treat and overcome congestive heart failure before giving atabrine.

If three doses of parenteral atabrine failed it was our intention to use oral quinidine in the accepted manner. Atabrine is excreted slowly, requiring 2 to 3 weeks after its administration is discontinued; therefore, we did not consider using oral atabrine because of the possible cumulative toxic effects (21) (26). Quinidine is excreted rapidly.

Auricular fibrillation is converted to normal sinus rhythm, with the use of quinidine, in about 60 percent of the patients (27) and with atabrine in about 50 percent (1). In previous reports where treatment with quinidine failed to restore normal sinus rhythm, atabrine was also unsuccessful. However, in these reports instances of auricular fibrillation associated with hyperthyroidism in which restoration of normal rhythm would not be expected without surgical intervention were included (1) (11) (12).

#### CASE REPORTS

**Case 1.**—A 36-year-old man with known rheumatic mitral valvular disease was admitted on 24 March 1949 because of dyspnea and vague joint pains. The physical findings were typical of mitral stenosis. Salicylates and bed rest were employed empirically although there was no evidence of rheumatic fever. After 3 weeks he was digitalized because of persistent dyspnea but his symptoms did not abate. One week later, while on maintenance doses of digitalis, he had auricular fibrillation. Three doses of atabrine (0.4 gm. each) were given intramuscularly 6 hours apart without effect. The following day quinidine (6 gr.) was given every 4 hours for 4 doses at which time the rhythm changed to a supraventricular tachycardia at a rate of 150. A few hours after this change he had chills and high fever which were assumed to be due to subacute bacterial endocarditis. Penicillin was given and the temperature became normal in 3 days. Attempts to stop the tachycardia by vagal stimulation were without effect. Quinidine, 6 gr. every 4 hours for 6 doses, was given without effect. Digitalis and quinidine were then discontinued, and 2 days later the rhythm changed to auricular fibrillation. Auricular fibrillation was still present 2½ months after onset, but, under sodium restriction, digitalis, and diuretics, compensation was maintained.

**Case 2.**—A 52-year-old man with known mitral stenosis and auricular fibrillation for 7 years had required maintenance doses of digitalis. In the past 2 years he had several episodes of decompensation. He was admitted on 11 April 1949 with symptoms compatible with splenic embolism. While under observation he had an attack of flank pain and transient hematuria interpreted to be due to a renal infarct and shortly thereafter he had a left hemiplegia. An attempt to restore normal rhythm with three doses of atabrine (0.4 gm. each) intramuscularly at 6-hour intervals failed. Six doses of quinidine, 6 gr. every 4 hours, were also given without altering the auricular fibrillation.

**Case 3.**—A 28-year-old man was discharged from the Navy in 1945 because of an "enlarged heart." He was asymptomatic until August 1948 when he had auricular fibrillation. The rhythm was restored to normal with digitalization and quinidine, 6 gr. every 4 hours for 6 doses. Upon reducing the maintenance dose of quinidine from 3 gr. 3 times daily to 3 gr. once daily, he again had

auricular fibrillation. He was digitalized and quinidine was given as before. He remained asymptomatic for 8 months when he had a third paroxysm of fibrillation. He was readmitted on 29 April 1949 with auricular fibrillation and findings typical of mitral stenosis. There was no evidence of decompensation. He was given atabrine, 0.4 gm. intramuscularly at 6-hour intervals for 3 doses without effect. Subsequently, he was digitalized and the rate slowed from about 120 per minute to about 100 but the arrhythmia persisted. After digitalization atabrine, 0.4 gm., was given intramuscularly for 6 hours but without effect. Quinidine, 6 gr. every 4 hours, was then given orally. The rhythm changed to a sinus mechanism after the third dose of quinidine. Digitalis was discontinued and the patient was discharged. Maintenance doses of oral quinidine, 3 gr. 3 times daily, were prescribed.

**Case 4**.—This 37-year-old man was admitted on 9 September 1949 complaining of allergic skin reaction following the local application of a sulfonamide. He had had uncomplicated scarlet fever in childhood. In July 1949 he had a 3-day attack of "engorgement of the lungs" and was then told that his heart rhythm was irregular.

Physical examination revealed a generalized bullous urticarial eruption over the entire body except for the face, hands, and feet. The heart was enlarged to the left. A murmur typical of mitral stenosis and an irregular rhythm characteristic of auricular fibrillation was heard. The apical rate was 102 and the radial rate was 88.

After appropriate therapy he was digitalized on 16 September 1949 with oral digitoxin and the following day he was given three doses of atabrine dihydrochloride, 0.4 gm. intramuscularly in 1 percent procaine at 6-hour intervals. The fibrillation remained unchanged. The next day quinidine sulfate, 3 gr. every 4 hours, was given. This dose was ultimately increased to 9 gr. every 4 hours without effect on the fibrillation.

**Case 5**.—A 54-year-old man was admitted on 15 March 1949 with right hemiplegia and aphasia. He had had hypertension for 3 years. At the time of admission the blood pressure was 145/100, the electrocardiogram showed left axis deviation with a left ventricular strain pattern, and coronary insufficiency. On 16 April 1949 he was found to have a cardiac arrhythmia which both clinically and by electrocardiogram was auricular fibrillation. He was given atabrine, 0.4 gm. intramuscularly, at 6-hour intervals. The rhythm changed to a sinus mechanism 3 hours after the second dose. He was discharged, no further therapy was required.

**Case 6**.—A 60-year-old white man was admitted on 21 April 1949. He complained of substernal distress of several hours duration. There was a long history of hospitalization because of cardiac disability. Examination revealed a blood pressure of 150/120 and a normal sinus rhythm. During examination he had generalized clonic convulsions, became cyanotic, and the pulse and blood pressure were imperceptible. An electrocardiogram (leads electrodes in place at the time of the convulsion) revealed first an auricular fibrillation and then a pattern interpreted as ventricular tachycardia. Atabrine, 0.2 gm. in 6 cc of 1 percent procaine, was injected into the heart, followed in a few minutes by 10 cc. of 1 percent procaine. At the same time atabrine, 0.2 gm., was given intramuscularly. Within a few minutes the electrocardiogram pattern reverted to that of auricular fibrillation interrupted by runs of ventricular tachycardia and the patient's general condition improved. Five hours later atabrine, 0.4 gm., was given intramuscularly and, about 3 hours later, the rhythm was noted to be

regular, confirmed by electrocardiogram. He remained in coma for 36 hours but made an uneventful recovery without any evidence of arrhythmia or signs of decompensation. Serial electrocardiograms failed to reveal any evidence of myocardial infarction. On 3 June 1949 he developed a fulminating bronchopneumonia and died within 48 hours. Autopsy showed no cardiac abnormality and no myocardial infarctions either fresh or old. The coronary arteries showed moderate arteriosclerosis but were not occluded.

**Case 7.**—A 79-year-old man was admitted on 23 April 1949 following pulmonary embolism secondary to phlebothrombosis. According to his physician an auricular flutter based on arterio-sclerotic heart disease had been present since the attack. This did not respond to adequate digitalization and small doses of quinidine. On admission he manifested slow auricular flutter (auricular rate 180, ventricular rate 60). Atabrine, 0.4 gm, intramuscularly, was given five times, twice on the day of admission at 6-hour intervals and three times the following day, without influencing the rhythm in any perceptible manner. Subsequently all cardiac drugs were discontinued for 1 week following which he was redigitalized with digitoxin. The arrhythmia was not changed. Six doses of quinaldine, 6 gr. at 4-hour intervals, were then given and a sinus rhythm interrupted by occasional premature ventricular contractions occurred. The patient made a satisfactory recovery. Maintenance doses of digtoxin and quinaldine were prescribed.

**Case 8.**—A 40-year-old white man was admitted on 11 May 1949 in mild shock with a diagnosis of massive anterior myocardial infarction. This was confirmed by electrocardiogram. During the third hospital day he lapsed into profound shock and had an absolute irregularity of the cardiac rhythm interpreted clinically as auricular fibrillation (electrocardiogram not obtained). In addition to blood transfusions and plasma, atabrine, 0.2 gm, in saline, was given intravenously. The rhythm became normal about 2 hours later and the blood pressure rose appreciably. About 8 hours after the restoration of normal rhythm the blood pressure again fell, and the rhythm was again irregular. Atabrine was administered intravenously as before but this time without effect. The patient died. At autopsy a recent massive anterior myocardial infarction was found.

**Case 9.**—A 53-year-old man was admitted on 27 June 1949 because of sudden onset of angina, weakness, fatigability, and palpitation in the chest 6 hours previously. An electrocardiogram showed auricular fibrillation. Two doses of atabrine, 0.4 gm, in 10 cc. of 1 percent procaine, were given 6 hours apart without effect on the fibrillation. About 48 hours after admission (36 hours after atabrine) the rhythm spontaneously became normal. Subsequent electrocardiograms revealed changes suggestive of coronary insufficiency, but no infarction pattern appeared on serial tracings.

**Case 10.**—This 58-year-old man was admitted to the hospital on 11 August 1949 complaining of "high blood pressure" for 15 years, dyspnea and ankle edema for 8 months, and weakness of the left side for 1 month. He had been taking digitalis. There was no clear indication as to the time of onset of fibrillation.

Physical examination revealed a dyspeptic man whose blood pressure was 250/140; pulse, 50; and apical rate, 72. The cardiac rhythm was irregular; the heart was enlarged to the left; and no murmurs were detected. There was a partial left hemiparesis. An electrocardiogram showed auricular fibrillation.

Digitalis and other medications including physical therapy were prescribed. The blood pressure remained 200/120.

Six weeks after admission he had several attacks of nocturnal paroxysmal dyspnea. After a satisfactory prothrombin level had been obtained with dicumarol, on 6 October 1949 he was given three intramuscular doses of atabrine, 0.4 gm in 1 percent procaine at 6-hour intervals, without effect on his cardiac rhythm. The next day he was given quinidine sulfate, 3 gr every 2 hours for eight doses, without effect on the fibrillation. Quinidine was then discontinued because of nausea.

His course after this was downhill and he died on 20 October 1949.

**Case 11**—A 52 year-old white man was admitted on 12 September 1949 complaining of dyspnea on exertion, primum nocturnal dyspnea, orthopnea, and substernal pain radiating to the right of the sternum for 3 months, palpitation for 6 weeks, and ankle edema for 3 days. There had been no previous cardiac complaints.

The patient was a moderately obese and dyspneic white man with dullness and absent breath sounds at both bases of the lungs. The heart was enlarged 2 cm to the left of the midclavicular line in the sixth intercostal space. There was an irregular rhythm with an apical rate of 110 and a pulse rate of 92. The blood pressure was 140/100. The liver was palpable 6 fingersbreadths below the right costal margin and was quite tender. There was a moderate edema of the ankles. He was treated by digitalization and maintenance doses of digitoxin, mercurial diuretics, ammonium chloride and a salt-poor diet. By 21 September 1949 he no longer showed signs of failure but he still had auricular fibrillation. On that date he was given three doses of atabrine, 0.4 gm intramuscularly in 1 percent procaine at 6-hour intervals. Twenty-four hours later his rhythm was still irregular. On 22 September 1949 quinidine sulfate 3 gr every 4 hours was given. After 2 days, normal sinus rhythm occurred. He was discharged 1 week later. Maintenance doses of digitoxin and quinidine, 3 gr three times daily, was prescribed.

**Case 12**—A 2½-year-old girl had attacks of supraventricular tachycardia since the age of 7 months. There was no evidence of organic heart disease. Each episode was successfully treated by digitalization. Atabrine, 0.1 gm intramuscularly, was given twice 4 hours apart during the seventeenth and eighteenth attacks. Both times the pulse gradually slowed to normal during the 3 hours after the second injection. Review of the history shows that similar response was noted following digitalis therapy previously and that the attacks lasted from 12 to 24 hours no matter what therapy was employed.

A subsequent attack of tachycardia again became normal 1 hour after a second dose of atabrine 0.1 gm, was given intramuscularly.

**Case 13**—A 27-year-old woman was admitted on 1 May 1949 because of chest pain, dyspnea and tachycardia. She was emotionally unstable and this had been apparent to previously consulted physicians. (Her husband had recently died of mural thrombus (auricular fibrillation).) An electrocardiogram revealed a nodal tachycardia, rate 140. Atabrine, 0.3 gm (patient's weight was 110 pounds) was given intramuscularly. The rhythm suddenly became normal 3½ hours later and her symptoms immediately subsided.

**Case 14**—A 52 year-old man was admitted on 12 September 1949 complaining of dyspnea, orthopnea, nausea, desire to defecate, palpitation, and heartburn. All symptoms had appeared suddenly 2½ days previously. He had had no previous history of cardiac or gastrointestinal complaints. He had a tachycardia, rate 200, with the rhythm slightly irregular, the blood pressure was 150/90, but there were no signs of congestive failure. An electrocardiogram revealed

a nodal tachycardia, rate 180. That day he was given three injections of atabrine, 0.4 gm. in 1 percent procaine, intramuscularly, at 6-hour intervals. The rate slowed to 140. Two hours after the last dose of atabrine he was given 1.2 mg. of digtoxin by mouth and quinidine sulfate, 6 gr. every 4 hours. Eight hours later his rhythm became and remained normal. There was no evidence of myocardial infarction, and the patient was discharged on 17 October 1949. Maintenance digtoxin and quinidine sulfate were prescribed.

**Case 15.**—A 65-year-old white man was admitted 25 October 1949 complaining of severe dyspnea of 2 days' duration. Previously he had had dyspnea on exertion for 2 years. He had no chest pain.

On physical examination the patient was orthopneic and cyanotic and the neck veins were distended. Bilateral rales and wheezes were heard at both lung bases; the heart was enlarged to the left of the midclavicular line; and the rhythm was rapid and regular at 180. The liver was tender and palpable 4 cm. from the right costal margin. There was no ankle edema.

An electrocardiogram revealed a supraventricular tachycardia, rate 180. Attention was first directed to the congestive failure. He was digitalized with intravenous cedilanid, given oxygen, morphine, and atropine every 4 hours, aminophylline intravenously and by mouth, and a "bloodless phlebotomy" by rotation of tourniquets. The next morning (26 October 1949) he had less dyspnea, the chest was clearer, but the tachycardia persisted (rate 178). That day he was given 4 doses of atabrine, 0.4 gm. intramuscularly every 6 hours. On 27 October 1949 the electrocardiogram showed a mixed auricular flutter-fibrillation. Quinidine, 3 gr. every 4 hours, was given and after 24 hours electrocardiogram showed a rate of 140 and a nodal tachycardia. The dose of quinidine was increased to 6 gr. every 4 hours and a day later, on 29 October 1949, the electrocardiogram showed auricular fibrillation.

After another 6 doses of quinidine, 6 gr. every 4 hours, the rhythm was found to be normal with a rate of 94. Since that time the rhythm has been regular. Maintenance doses of digtoxin and quinidine, 3 gr. 4 times daily, were continued.

#### COMMENT

Atabrine parenterally is of no more value than oral quinidine in restoring auricular fibrillation associated with mitral stenosis to normal rhythm in either acute or chronic cases. In one patient with acute fibrillation, quinidine was successful three times; whereas, atabrine on the one occasion it was used was of no avail.

In the arteriosclerotic and hypertensive group, in three patients with acute auricular fibrillation normal rhythm was restored by atabrine. One patient probably had ventricular fibrillation in addition. The result here is clouded by the fact that procaine was given intracardiacly and intravenously at the same time. In one patient in whom normal rhythm was restored by atabrine, death occurred 8 hours later from resumption of fibrillation. This might have been prevented by administering oral quinidine after normal rhythm was established.

No patient with hypertensive and arteriosclerotic heart disease with chronic arrhythmias was benefited by the use of atabrine. However, the patients with auricular flutter and auricular fibrillation were converted by quinidine. From this small series it appears that atabrine is not as efficacious as quinidine.

In auricular fibrillation associated with nonvalvular heart disease, especially that of short duration, normal rhythm was restored in five out of seven patients (71.4 percent) while in fibrillation associated with valvular disease normal rhythm occurred in one out of four (25 percent).

Atabrine or quinidine restored normal rhythm in all four patients with tachycardia. Two of these were of the type (supraventricular) in which normal rhythm may return spontaneously. In two patients the accompanying coronary arteriosclerosis was evidenced by signs of congestive failure. Atabrine failed to restore normal sinus rhythm, but after administering quinidine for from 48 to 72 hours normal rhythm occurred. In our series of 15 cases normal rhythm was restored with atabrine in 5, with quinidine in 5, and 5 were failures, giving a total conversion rate of 66 percent. In previous reports (1) (27) normal rhythm was restored in 60 percent with quinidine and in 50 percent with atabrine. It is realized that the number of cases is statistically too small to draw significant conclusions. However, the results suggest that with the use of both drugs in the future, perhaps a slightly higher percentage of cases might be converted.

If the patients with tachycardia are excluded from the results it may be seen that in 54.6 percent of patients with auricular fibrillation, including one of auricular flutter, normal rhythm is restored by the use of either atabrine or quinidine. This figure compares favorably with those previously reported (1) (27).

#### SUMMARY

Atabrine's value appears to be in the treatment of auricular fibrillation of short duration associated with nonvalvular heart disease. It was of no more value than quinidine in patients with chronic fibrillation either with or without valvular disease and is of questionable value in the treatment of supraventricular tachycardia.

In our series restoration of normal rhythm with the use of atabrine or quinidine was successful in 66 percent of patients with arrhythmias.

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SONIC VIBRATED LEPTOSPIRAE AS ANTIGENS IN THE COMPLEMENT FIXATION TEST FOR THE DIAGNOSIS OF LEPTOSPIROSIS. by Raymond Randall, Colonel, F.C., U. S. A., Psyche W. Wetmore, and Albert R. Warner, Jr. Journal of Laboratory and Clinical Medicine 34: 1411-1415, Oct. 1949

Because a simple and reliable diagnostic test for leptospirosis was not available, a study was undertaken to develop an antigen for use in a complement fixation test that could be performed in my laboratory conducting the Wassermann or similar complement-fixation tests. Since antigens prepared by the usual methods gave unsatisfactory results, experiments were undertaken to produce a suitable antigen, and it was found that leptospirae captured by sonic vibration yielded an antigen of considerable specificity and sensitivity. Serums from patients with leptospirosis caused by *Leptospira icterohaemorrhagiae* and *Lept. grippotyphosa* reacted with *Lept. canicola* and *Lept. icterohaemorrhagiae* antigens to titers regarded as specific for leptospirosis.—Abstract



# Assay of Gonadotropins in the Diagnosis of Neoplasms

JOHN A. SHIRLEY, *Captain, MC, A. U. S.<sup>1</sup>*

DETERMINATION of the excretion of gonadotropins in the urine is of value in diagnosing neoplasms arising from the testes and the chorionic villi. Normally, the anterior lobe of the pituitary stimulates the ovaries and testes by means of specific gonadotropins that are believed to be secreted by the basophilic cells of this gland. One of these substances is known as follicle stimulating hormone (FSH) or prolan A. This substance, in women, stimulates the growth and maturation of ovarian follicles, and in the presence of a small amount of luteinizing hormone results in estrogen production and ovulation. In men this hormone stimulates the cells of the seminiferous tubules and produces spermatogenesis. Another gonadotropin which is secreted by the pituitary is the interstitial cell stimulating hormone, luteinizing hormone, or prolan B. This substance stimulates the interstitial cells of the ovary in some animals and in human beings stimulates the granulosa cells to undergo luteinization and form the corpus luteum after they have been under the influence of FSH. In male animals it stimulates the interstitial cells of Leydig to produce the male sex hormone. This hormone can also stimulate the seminiferous tubules indirectly, since it stimulates the Leydig cells, which, in turn, release testosterone. Thus, at least in small doses, seems to promote spermatogenesis. A third hormone of the pituitary, the lactogenic hormone, is capable of inducing and maintaining lactation in the breasts of animals with intact pituitary glands. It also prolongs the life of the corpus luteum. The chorionic trophoblastic cells of the human placenta also produce a gonadotropin. It has a luteinizing action, and, consequently, is frequently referred to as "anterior pituitarylike hormone." Normally, in pregnant animals, its function seems to be stimulation of the luteal cells in order that they keep functioning until the placental tissue starts the formation and secretion of progesterone. In contrast to the pituitary luteinizing hormone, however, it possesses no important stimulating action on the

<sup>1</sup>Fourth Army Area Medical Laboratory, Fort Sam Houston, Tex.

ovaries in human beings other than prolongation of the presence of the corpus luteum. In male mammals it brings about testicular descent in cryptorchism and is capable of stimulating the interstitial tissue with a resultant outpouring of androgens. Equine gonadotropin is produced by the placenta of the pregnant mare and is present in the blood of this animal during pregnancy. It is unique in that it is not excreted in the urine of the pregnant mare and also in that it has both follicle-stimulating and luteinizing properties.

All of these substances are complex glycoproteins that vary in their isoelectric points, in their molecular weights, and in the composition of the active carbohydrate and amino nitrogen groups. All are soluble in water and may be precipitated by alcohol, benzoic acid, or tannic acid, a property that allows their concentration and partial purification in the quantitative Aschheim-Zondek test. Their potency is lost slowly on standing in solution, and is destroyed readily by heating, or by excess acid or base.

The tests for gonadotropins in urine or blood can be divided into qualitative tests for the diagnosis of pregnancy, and quantitative tests that determine the excretion of gonadotropins in the urine in 24 hours. The pregnancy tests vary not only with the animals used, but also with the time required to carry out the determination. In the Aschheim-Zondek test, immature female mice or rats are usually used. While 96 hours are needed for the completion of this test, only 48 hours are needed for the Friedman test, which uses mature female rabbits that have been isolated for 3 weeks. Several pregnancy tests requiring less than 24 hours for their completion are available. One such test depends on the hyperemia of the ovaries produced in the immature rat by the injection of urine containing chorionic gonadotropin; the optimum time for reading the reaction varies from 2 to 24 hours according to various investigators. Another group of rapid pregnancy tests uses various species of frogs and toads. The South African clawed toad (*Xenopus laevis*) reacts to the injection of urine from a pregnant woman by the extrusion of grossly visible ova, usually within 24 hours, while the male South American toad (*Bufo arenarum*) and the male North American frog (*Rana pipiens*) react to chorionic gonadotropin by the release of spermatozoa, usually within 2 hours. These can be easily seen by microscopic examination of the cloacal fluid.

The only test which has been consistently used for quantitative assay of gonadotropins is the quantitative Aschheim-Zondek test. The Fourth Army Medical Laboratory uses the quantitative Aschheim-Zondek test as modified by Cutler and Owen (1) and by Vermoorten and Hettler (2). The gonadotropins are concentrated by precipitation from aliquots of a 24-hour specimen of urine by adding 5 vol-

munes of 95 percent ethyl alcohol and allowing the mixture to stand overnight at 4° C. The precipitated glycoproteins are next washed with ether, dried, and put into solution by dissolving them in 8 cc. of distilled water, giving either a fivefold or tenfold concentrate, depending on whether 40 cc. or 80 cc. of urine was used. The concentrate is injected subcutaneously into immature female mice, weighing 8 to 10 gm., in 5 doses, 2 on the first day, 2 on the second day, and 1 on the third day. One mouse is given a total of 0.5 cc. of the fivefold concentrate which equals 2.5 cc. of urine while others receive an equivalent of 5, 10, and 20 cc. of urine. The last is injected with the tenfold concentrate. The mice are killed with chloroform 48 hours after the last injection and are examined for enlargement of the uterus and/or formation of either hemorrhagic follicles or corpora lutea.

The mouse unit (M. U.) with which the gonadotropins are measured equals the smallest dose of urine expressed in milliliters that produces unmistakable enlargement, usually with hyperemia of the bifurcated uterus, and/or hemorrhagic follicle or corpus luteum formation. One thousand divided by this unit equals the M. U. per liter. Since it takes about five times as much gonadotropin to cause ovulation as it does to induce secondary estrus with enlargement of the uterus and opening of the vaginal orifice, the mouse units giving an enlarged uterus are multiplied by five if the ovaries show either corpora hemorrhagica or corpora lutea (2). The amount of the gonadotropins needed to form corpora hemorrhagica or corpora lutea is influenced by the ratio of FSH and chorionic gonadotropin present in the urine as well as possible activity of the test animal's pituitary. Nevertheless it has been the experience of the writer that the fivefold relationship is usually present. The technique and reading of the quantitative tests are summarized in table 1. The 50 and 100 M. U. assays are run in duplicate since these mice receive the more concentrated solutions, and consequently are more prone to die. If all of the mice tested show positive findings, the assay can be carried even farther by the use of undiluted and diluted urine (table 2).

TABLE I

Test mouse	Schedule of injections					Total dose in milliliters	Equivalent quantity of urine in milliliters	M. U./L required to produce positive	
	A M	P M	A M	P M	A M			Uterine findings	Ovarian findings
1	0.1	0.1	0.1	0.1	0.1	0.5	2.5	400	2,000
2	2	2	2	2	2	10	5.0	200	1,000
3	.4	.4	.4	.4	.4	2.0	10.0	100	500
4	.4	.4	.4	.4	.4	2.0	10.0	100	500
5	.4	.4	.4	.4	.4	2.0	20.0	20	220
6	.4	.4	.4	.4	.4	2.0	20.0	20	220

TABLE 2

Test mouse	Total amount of urine given in 8 injections	M. U./L. required to produce positive	
		I terine findings	Overian findings
1	2 ml. of undiluted urine	500	2,500
2	1 ml. of undiluted urine	1,000	5,000
3	2 ml. of urine diluted 1/10	5,000	25,000
4	1 ml. of urine diluted 1/10	10,000	50,000
5	2 ml. of urine diluted 1/100	50,000	250,000
6	1 ml. of urine diluted 1/100	100,000	500,000

The amount of the gonadotropin excreted in the urine of normal persons is important if this assay is to be used for diagnostic purposes. Gonadotropins do not appear in the urine until about a year before the onset of menstruation in girls, and in boys a positive response cannot be obtained before the age of 12 or 13 years (3). The normal values obtained in adults vary somewhat with different methods of concentration of gonadotropins in the quantitative Aschheim-Zondek test and also the endpoints used. The levels presented here are those obtained by this laboratory and other laboratories using similar techniques (4) (5) (6), and refer to gonadotropins arising from the pituitary gland.

The normal menstruating woman excretes up to 100 M. U. in 24 hours usually with a peak of excretion near the middle of the cycle which is probably related to ovulation, while the castrated or post-menopausal women will excrete up to 500 M. U. of gonadotropins in 24 hours. Here the pituitary gland attempts to stimulate an organ that is either no longer present or nonfunctional, thereby increasing the amount of FSH formed for a period varying from 6 months to 30 years (3). On the other hand, the normal man excretes less than 50 M. U. in 24 hours. In some hypogonadic or castrated men the excretion is slightly elevated, but never as high or as constant as in post-menopausal women.

The group of neoplasms with which quantitative studies of gonadotropin are most frequently used as an aid in diagnosis in the Army, are the testicular tumors (seminoma, teratoma, embryonal carcinoma, teratocarcinoma, and chorio-epithelioma). This group of tumors according to Friedman and Moore (7) probably arises from embryonic germ cells, with the seminoma coming from primordial germ cells and being composed of mononuclear growths. On the other hand, teratoid tumors and embryonal carcinomas which, according to these workers, include the chorio-epitheliomas, probably arise from more primitive embryonic germ cells which have the capacity to form both somatic and trophoblastic tissue. Occasionally seminomas will metastasize with formation of trophoblastic tissue, indicating that there must be primitive embryonic cells present in these tumors at times. Patients

with testicular tumors may excrete an abnormal amount of the gonadotropins in the urine and their urine will occasionally give a positive test for pregnancy. Ferguson (8) attempted to correlate the type of neoplasm found with the amount of the gonadotropins formed and proposed a classification of these tumors which was based on the amount of the gonadotropins in the urine. He believed that the larger the amount of this hormone excreted, the more embryonal the tumor as well as the larger the mass of viable tissue present. Ferguson also believed that the embryonal tumor, as it grew, produced an unidentified substance or hormone which stimulated the anterior lobe of the pituitary to secrete an increase of FSH.

It appears, however, that the pituitary gland does not enter into this process, but that the embryonic tumor itself forms the gonadotropins since the tumor tissue can be shown to have a high concentration of the active material if there is exertion of these substances before removal of the neoplasm (9). The presence of abnormal amounts of gonadotropins in the urine is not related so much to the structure of the tumor as to whether there is chorionic tissue present either in the primary tumor or in the metastases. Furthermore, Ferguson's belief that the quantitative test is a reliable means of differentiating types of testicular tumors is no longer accepted. Cahill (10) stated that the amount of the gonadotropins present with these tumors is an index of the amount and activity of syncytial secreting cells (presumably syncytiotrophoblasts). On the other hand, Stewart and his co-workers (11) reported that tissue cultures of placental tissue show a direct correlation between the growth of cytotrophoblasts and the production of gonadotropins. They were unable, however, to grow the syncytial cells well enough so that they could determine which, if any hormones, were elaborated by these cells. Further evidence that the cytotrophoblast is instrumental in the elaboration of gonadotropin, is the observation that at about the middle of pregnancy, when normally the excretion of gonadotropins is decreasing, the layer of cytotrophoblasts disappears in the placental villi (12). Whether it is only one or both of these cells which secrete gonadotropin is not clear.

Although focal chorio-epitheliomas are rarely observed in seminomas, about 4 percent of the 922 tumors studied by Friedman and Moore (7) contained both seminomatous and embryonal carcinomatous tissue. Even though the tumor is primarily a seminoma, the metastases may be embryonal carcinoma with active secretion of gonadotropin. An example is the following case.

#### CASE REPORT

A 33 year-old man first noted a hard painless nodule on one testis in March 1947. An assay of urinary gonadotropins revealed less than 100 M. U. per

liter of urine at this time but 1 month later revealed 200 M U per liter. Several examinations revealed 100 M U per liter. A unilateral orchidectomy was performed and the pathologic diagnosis was seminoma without extension into the cord vessels. About 2 months later, 2,000 M U of gonadotropin per liter of urine was found, and high voltage roentgen therapy was started. In November, an intravenous pyelogram revealed a deviation of one ureter, which was thought to be caused by a retroperitoneal mass. The excretion of gonadotropins at this time varied from 2,000 to 5,000 M U per liter. A retroperitoneal lymph node was resected and the microscopic examination revealed an undifferentiated carcinoma.

The patient died after a rather long and stormy illness. An assay of gonadotropins several months before death showed more than 10,000 M U excreted in the urine in 24 hours. Unfortunately, the exact level was never determined.

The autopsy showed multiple visceral and pulmonary metastases while the microscopic examination showed this to be an embryonal carcinoma with some of the characteristics of a seminoma.

In contrast a 26-year-old soldier whose primary tumor was an embryonal carcinoma had widespread metastases before death and only embryonal carcinoma was found. The highest titer of gonadotropins obtained in this case was 150 M U in 24 hours.

Friedman and Moore (7) stated that in their series of 922 testicular tumors some embryonal carcinomas had a striking morphologic resemblance to the cytotrophoblastic cells of chorio-epitheliomas. This may explain the elaboration of gonadotropins by tumors that are considered embryonal carcinomas and not chorio-epitheliomas. It is possible that these cells are so anaplastic that they have lost their power to elaborate this hormone. Another factor which is not always appreciated is that in any pathologic examination only a few blocks of tissue are taken from a tumor or its metastases for study, and chorionic tissue may not be present in the blocks chosen (18).

The hormone produced by the malignant tissue is chorionic in type (14) (15). The fact that about 12 percent of these malignant tumors arise in undescended testes may be confusing and many of these patients probably represent hypogonadal states in which the pituitary is attempting to stimulate these organs by an increase in the FSH produced (15) (16). Either unilateral castration or destruction of a testis by the tumor may decrease the amount of androgens secreted in the body with a resultant increase, usually slight in the amount of the gonadotropins in the 24-hour urine specimen (2). This is caused by an increase in the FSH elaborated by the pituitary. Postoperative high voltage roentgen therapy to the genital area may be the factor in this castration effect, but the roentgen rays primarily affect the seminiferous tubules and have relatively little effect on the Leydig cells which secrete the androgens (17). The differentiation of pituitary gonadotropin (FSH) and chorionic gonadotropin involves the use of either hypophysectomized female rats which give only luteinization of thecal cells when stimulated with chorionic gonadotropin or the destruction

of the FSH by extraction of the chorionic gonadotropin with tricresol. Careful examination of the amount of the gonadotropins needed to increase the weight of the ovaries of infantile rats may also be used since small amounts of FSH will give a maximum weight increase rapidly in contrast to the slower action of large doses of chorionic gonadotropin (15). One can readily see that the differentiation of these two hormones in the ordinary laboratory is impractical.

The fact that there is abnormal excretion of gonadotropins as assayed by the usual methods in a patient with a testicular tumor is of little use in determining whether metastases have occurred preoperatively. If, however, a high value is obtained, one can usually assume that trophoblastic tissue is present. After the primary tumor has been removed, persistent high abnormal excretion of gonadotropins or a rise after an initial fall in titer is evidence that secretory metastatic cells are present elsewhere in the body. Usually quantitative assays of gonadotropins are determined postoperatively every month for at least 3 months with a gradual lengthening of the intervals for the next 3 to 5 years.

The assay of excreted gonadotropins is also of aid in the diagnosis of both hydatid moles and chorio-epitheliomas in women. Both are derived from chorionic tissue and, as such, they elaborate varying amounts of the gonadotropins. Normally, about 4 weeks after conception the amount of the gonadotropins in the urine increases and steadily rises to a peak between the sixth and twelfth weeks of gestation. The excretion of gonadotropins then drops rapidly to a much lower level during the remainder of pregnancy. After the delivery of the placenta, the level of gonadotropins falls rapidly, and within a week usually reach levels observed in nonpregnant women. Whereas, in a normal pregnancy the peak of excretion of gonadotropins is reached in the first trimester, in hydatid degeneration of the placenta, there is usually a larger excretion of gonadotropins in the third to fifth month of pregnancy (i. e. from 200,000 to several million M. U. in 24 hours) when normally the titer of gonadotropins is decreasing (18). The excretion of gonadotropins appears to be roughly proportional to the amount of trophoblastic tissue present. By means of tissue culture, Jones, Gey, and Gey (19) showed that tissue from both ectopic pregnancies and hydatidiform moles produces gonadotropins for periods of 2 to 6 months. In general, if a malignant chorio-epithelioma occurs, the excretion of gonadotropins is even higher than in a patient with a hydatid mole. Significance is placed on the detection of gonadotropins in the spinal fluid in patients with hydatid mole and chorio-epithelioma, which is said never to occur in a normal pregnancy (18). Several cases of normal pregnancy have been recorded in which it was possible to obtain a positive Aschheim-Zondek test (20). Hydatidiform moles and chorio-epi-

theomas have also been known, on rare occasions, to elaborate virtually no gonadotropins (21). The excretion of gonadotropin is not only influenced by the amount of chorionic tissue present but also by its proximity to blood supply and the capacity of the cells present to elaborate this hormone. It may be that the absence of this capacity is an index of the degree of anaplasia of the tumor cells. Novak stated that both cytotrophoblasts and syncytial trophoblasts participate in the malignant process of a chorio-epithelioma, but that it is commonly believed that tumors showing a predominance of syncytial elements are less malignant than those in which the cytotrophoblasts predominate (12).

The usual procedure after the passage of a hydatid mole, is to obtain periodic 24-hour quantitative assays of gonadotropins in order to detect either residual chorionic tissue or the development of a chorio-epithelioma. Levels of detectable gonadotropin may, however, persist for 4 to 12 weeks after successful passage of a hydatid mole, since the time required for these levels to disappear depends on the original height of the blood level and the rate of excretion.

Each patient who has passed a hydatid mole should be followed by quantitative studies of gonadotropins every 2 to 4 weeks for the first 6 months, every 2 or 3 months in the second 6 months, and at least twice a year thereafter for several years. Since a single determination is of limited value, it is important to determine whether the hormone is increasing or decreasing. No matter how long after removal of the tumor, falling levels can only mean that no new hormone has been produced and that there is no functioning chorionic tissue left. Any rise in level indicates either recurrence of the tumor, the development of malignancy, or another pregnancy.

Since gonadotropins are produced by the basophilic cells of the pituitary in the normal person, one would expect excessive amounts of these hormones in cases of pituitary basophilic tumors which may be the cause for some cases of Cushing's syndrome. This occurs only sporadically, if at all, and relatively early in the course of the disease (3). Consequently, the value of the assay for these substances is practically nil in this pathologic entity.

#### CONCLUSIONS

The quantitative determination of the excretion of gonadotropins in the urine is of aid in the diagnosis of neoplasms arising from the testes and from the chorionic villi. Because of the variation encountered, this assay should be used only as confirmatory evidence in the diagnosis of these neoplasms and should not be regarded as a necessary diagnostic criterion. The quantitative assay of gonadotropins is also of aid in the detection of metastases or recurrence of these tumors.

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# An Evaluation of the Treatment of Chronic Osteomyelitis

ROBERT F. LEGGE, Captain (MC) U. S. N.<sup>1</sup>

WILLIAM H. SCHWINGER, Lieutenant, junior grade (MC) U. S. N. R.<sup>1</sup>

SVENTY-TWO cases of chronic osteomyelitis observed and treated over a period of 20 months are presented in order to compare the results of several methods of treatment. The average age of the patients in this series was 25, the youngest was 19 and the oldest was 36. In 90 percent, the etiologic factors were either gunshot wounds or compound fractures from other causes, 5 cases followed open reduction, and in 3 the lesion was hematogenous. Bacteriostatic agents including penicillin, streptomycin, and the sulfonamides were used systemically in each case according to the indication determined by the type of organism and its sensitivity and resistance. None was used locally in conjunction with any of the surgical procedures. The most common organism recovered from the wounds was hemolytic *Staphylococcus aureus* (61 percent). Others included *Proteus*, *Staph. albus*, *Staph. aureus*, and *Bacterium coli*, in that order. The average period of drainage, preoperatively, was 12 months.

## SURGICAL TREATMENT

The incidence of bone involvement in 72 cases was as follows: tibia, 30 (42 percent); femur, 16 (22 percent); humerus, 8 (11 percent); ulna, 4 (6 percent); elbow, 3 (4 percent); radius, 2 (3 percent); pelvis, 2 (3 percent); finger, 2 (3 percent); ankle, 2 (3 percent); scapula, 1 (1 percent); os calcis, 1 (1 percent); and hip, 1 (1 percent).

The various operative procedures employed, together with the results in terms of postoperative drainage, are shown in table 1. The average period of drainage postoperatively for the entire series was 2 months. In 35 cases, or 49 percent, there was no drainage. In the remaining 37, or 51 percent, drainage persisted for an average of 3½ months.

<sup>1</sup> Orthopedic Service, U. S. Naval Hospital, USNTC, Great Lakes, Ill.

TABLE 1

Type of operation	Number of cases	Percent of series	Number of cases with no postoperative drainage	Percent with no postoperative drainage
Sequestrectomy	36	50	13	39
Saucerization	17	21	9	53
Saucerization plus muscle pedicle flap	7	10	6	86
Sinusectomy	5	7	4	80
Saucerization plus iliac chips	3	4	0	0
Sequestrectomy and epithelialization	2	3	1	50
Amputation	1	1	1	100
Resection of tibia	1	1	1	100
Total	72	100	35	-----

For purposes of comparison, the number of amputations and resections of the tibia, as well as the sequestrectomies and epithelialization, should not be included as they are too small in number to be of any significance. The latter cases consisted simply of the application of either split thickness or pinch grafts to the granulating areas within the depths of the wounds. In the small number treated by implantation of iliac bone chips in the manner described by Prigge (2), results were uniformly poor. However, in the cases treated by filling the defect with a muscle pedicle flap, a procedure referred to by Starr (4) as early as 1922, and described by Mercer (1) in 1933, the results were good enough to warrant further comment and more detailed analysis. It will be noted that the highest percentage of cases which remained closed (86 percent), fell in this group. This is essentially the same as the figure reported in a larger series by Stark (3) (84 percent).

Of the 7 cases treated by this method, 6 involved the femur, and in none of these was there any drainage postoperatively. The average period of preoperative drainage had been 13½ months. The remaining case involved the humerus, and in this case drainage persisted for 1 month postoperatively.

In order to provide a basis of comparison of methods of treatment and results obtained on specific bones, the following analyses of treatment of the femur and the humerus are presented. In 16 cases of osteomyelitis of the femur, the following operations were done: Muscle pedicle flap in 6 cases—no postoperative drainage; sequestrectomy in 5 cases—no postoperative drainage in 40 percent, the average period of postoperative drainage was 2 months; saucerization in 4 cases—no postoperative drainage in 50 percent, the average period of postoperative drainage was 3 months; and sinusectomy in 1 case—no postoperative drainage.

In 8 cases of osteomyelitis of the humerus the following operations were done: Sequestrectomy in 4 cases—no postoperative drainage in 25 percent, the average period of postoperative drainage was 1

month; sauerization in 3 cases—no postoperative drainage in 33 percent, the average period of postoperative drainage was 2 months; and muscle pedicle flap in 1 case with postoperative drainage for 1 month.

#### CASE REPORTS

**Sequestrectomy**—S. M. C., a 19-year-old man, was admitted on 22 September 1946 with a history of pain and swelling of the left knee of 3 months' duration. One week following admission the patient sustained a fracture of the left femur. Roentgenograms showed rarefaction and a moth-eaten appearance of the bone (fig 1). The leg was placed in traction and later in a hip spica. On 13



Figure 1.—Pathological fracture, periotitis, and osteomyelitis areas (18 November 1946).



Figure 2.—Sequestrum of fracture site (5 March 1947).

January 1947, check films showed the formation of a sequestrum at the fracture site (fig 2). Two months later a sinus developed, and on 7 March 1947, a sequestrectomy was performed with primary closure. Seven months later, there was no evidence of infection or drainage (fig 3).



Figure 3.—Four months after operation (15 July 1947).

**Sauveterization**—L. J. R., a 23-year-old white man, had an acute hematogenous osteomyelitis followed by drainage from the right hip on 21 December 1945. He was transferred to this hospital on 24 March 1946 with the leg in a hip spica. After removal of the cast the leg continued to drain in spite of massive doses of penicillin and local



*Figure 4.—Osteomyelitis of head of femur and sequestrum in acetabulum (18 July 1946).*



*Figure 5.—One year later, 8 months postoperatively, showing healing and beginning fusion.*

irrigations with tyrothricin (fig 4). On 7 November 1946, the acetabulum was sauerized, with removal of almost the entire iliac portion. The femoral head was denuded and a hip fusion was performed. The drainage ceased. However, on 28 December 1946, two sinuses appeared over the right buttock, and the cast was removed. Cultures revealed *Bacillus proteus*. The patient was given streptomycin, but no alteration in drainage occurred. On 4 March 1947, a sinusectomy of the right buttock was performed and numerous connecting sinuses were found in the fascial and muscle planes. These were completely resected and the incision closed primarily. No drainage occurred subsequently (fig 5). On 15 September 1947 roentgenograms showed complete fusion of the right hip.



*Figure 6.—Anteroposterior view showing sequestrum and necrotic areas (29 July 1946).*



*Figure 7.—Lateral view before operation.*



*Figure 8.—Postoperative roentgenogram.*



Figure 9.—Preoperative film, showing sinus injected with lipiodol.

1943. The wound apparently healed, but every 1 to 2 months abscess formation and drainage occurred. On 19 September 1946, a sinusectomy was performed and closed tightly and primary healing occurred (fig 8). Five months later the patient was discharged to duty. He had had no recurrence.

*Saueerization and iliac graft*—I. T. S., a 36-year-old white man, sustained a compound gunshot (motor) fracture of the upper third of the right tibia with loss of bone substance. A mixed pyocynneous infection followed. On admission to this hospital, 6 months later, the tibia had healed except for a bony defect of the anterior portion of the upper tibia which discharged foul, purulent material. Cultures revealed nonhemolytic staphylococcus and pyocynase. Seven months after admission, sauerization and sequestrectomy was performed. The wound continued to drain profusely, clearing up after 10 months of local therapy with penicillin and tyrothricin. The cavity remained and moderate discharge persisted (fig 10). On 21 September 1946, a second saueriza-



Figure 10.—Large cavity, prior to filling with silac chips (16 August 1946).

*Saueerization and muscle pedicle flap*—W. S. B., a 26-year-old white man, sustained a compound gunshot fracture of the left femur on 6 June 1945. The leg had been immobilized in a cast and the patient was transferred to this activity (figs 6 and 7). On 19 September 1946 the fracture was well healed, but drainage persisted. At this time a sauerization and muscle pedicle flap operation was performed on the left femur. The incision healed primarily, but 1 month following surgery a small sinus appeared, from which a suture was removed. The sinus healed primarily within 10 days and the patient was discharged from the hospital 6 months later, with no drainage and a full range of motion of the left knee and hip (fig 8).

*Sinusectomy*—N. L. H., a 34-year-old white man in October 1944 sustained a compound gunshot fracture of the neck of the left femur. Saueerization was performed in May

1945. The wound apparently healed, but every 1 to 2 months abscess formation and drainage occurred.

On 19 September 1946, a sinusectomy was per-

formed and closed tightly and primary healing occurred (fig 8). Five months

later the patient was discharged to duty. He had had no recurrence.

*Saueerization and iliac graft*—I. T. S., a 36-year-old white man, sustained a compound gunshot (motor) fracture of the upper third of the right tibia with loss of bone substance. A mixed pyocynneous infection followed. On admission to this hospital, 6 months later, the tibia had healed except for a bony defect of the anterior portion of the upper tibia which discharged foul, purulent material. Cultures revealed nonhemolytic staphylococcus and pyocynase. Seven months after admission, sauerization and sequestrectomy was performed. The wound continued to drain profusely, clearing up after 10 months of local therapy with penicillin and tyrothricin. The cavity remained and moderate discharge persisted (fig 10). On 21 September 1946, a second saueriza-



Figure 11.—Four weeks after placing of silac chips (15 November 1946).

tion and sequestrectomy was performed, followed by multiple iliac chip grafts on 17 October 1946. On 2 November 1946 the entire area became infected. A culture at this time revealed hemolytic streptococcus, gram-negative rods and *B. subtilis*. The wound was irrigated with acetic acid and tyrothricin alternately, without result (fig. 11). On 23 November 1946 the wound was completely cleaned out, and no viable bone chips were found. The patient was later discharged from the hospital although the wound was still draining.

**Amputation.**—F. L. V., a 25-year-old white man sustained bilateral compound trochanteric gunshot fractures of the femurs on 29 July 1945. The patient



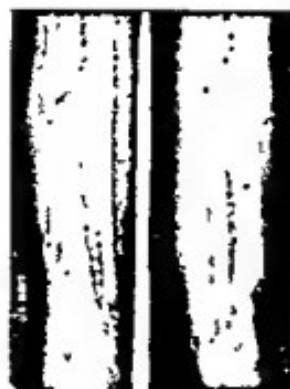
Figure 12.—Preoperative film (reversed in printing), showing massive infection of neck and upper shaft of right femur.

was admitted to this hospital on 20 June 1946 in a hip spica with multiple decubitus ulcers and a foul, purulent discharge from the wound in the right thigh. He had an ununited, comminuted, trochanteric fracture of the right femur; the left femur had united. Cultures at this time revealed gram-negative rods and streptococci. He also had bilateral urinary calculi and a pyelitis which was resistant to local treatment (fig. 12). On 6 January 1947 a disarticulation of the femur was performed and the stump allowed to granulate (fig. 13). Seven months later the patient was discharged from the hospital, free from wound drainage and urinary complications. He had gained 30 pounds in weight.

**Resection of middle third of tibia.**—R. L. C., a 22-year-old white man, sustained a compound, comminuted fracture of the tibia on 23 May 1946. Three days later an open reduction and immobilization, and immobilization of the fracture with a Lane plate, was done. Osteomyelitis occurred and the patient was transferred to this activity on 3 November 1946. The plate was removed on 13 December 1946, but the infection continued. On 28 February 1947, roentgenogram showed the middle third of the tibia to be sequestrating (fig. 14). On 4 March 1947 approximately 8 inches of the tibia was removed by block resection. The wound was closed tightly and it healed primarily (fig. 15). On 11 August 1947 the defect was replaced with a combined fibular and iliac graft (fig. 16). At the present time, approximately 3 months later, there has been no drainage.



Figure 13.—Three months after disarticulation of right hip.



*Figure 14.—Massive sequestration of large tibial fragment, immediately before operation.*



*Figure 15.—Three months after block resection.*



*Figure 16.—Split fibular intramedullary and on-lay grafts in place (on right); opposite leg from which graft was removed (on left).*

## SUMMARY

Seventy-two cases of chronic osteomyelitis have been reviewed in an attempt to demonstrate the relative value of several forms of surgical treatment.

Although the number of cases included in the several categories is not large, it is concluded that the use of the muscle pedicle flap, which produced excellent results in 86 percent in this series, is the method of choice in the treatment of chronic osteomyelitis.

The use of iliac clippings to fill existing cavities in bone was not successful in any case in this series.

Complete excision of the lesion, whether of the bony or the soft tissues, as in the case of massive resection or sinusectomy, will produce an almost perfect result in practically all cases.

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# Endometriosis of the Urinary Bladder

SIDNEY L. ARJE, *Commander (MC) U. S. N.<sup>1</sup>*  
GILBERT WEBB, *Lieutenant, junior grade (MC) U. S. N.<sup>1</sup>*

**I**N 1921, Judd (1) published the first case of "Adenomyoma presenting as a tumor of the bladder." Until 1943, when Moore, Herring, and McCannel (2) presented a critical analysis of the literature, there were only 46 cases on record; since then 19 more cases have been added. The authors believe that this problem should be brought to the attention of the gynecologist as the recognition of the disease at the time of surgery and a knowledge of correct treatment are important to him as well as to the urologist.

## CASE REPORT

D. W., a 29-year-old white gravida 1, para 0, was admitted to the hospital on 24 December 1948, complaining of a dull constant pain in the left lower quadrant of the abdomen with sharp knife-like exacerbations every 1 to 2 minutes, which lasted only a few seconds and radiated to the left flank. The pain was severe enough to double her up. There were no urinary complaints, no nausea or vomiting, but she had been constipated for the past 2 or 3 days. She stated that the pain was just like that which she had had in 1941 just before her right tube was removed for a ruptured ectopic pregnancy; the appendix had also been removed then.

Her last menstrual period was 17 November 1948 and was normal, lasting 2 days. Ten days prior to onset of the present illness she spotted for 2 days, but this was not as heavy as a normal period.

Her menarche was at the age of 18, her periods were regular, every 28 days, lasting 2 days. There was no dysmenorrhea, dysuria, hematuria, or other complaints. A review of systems was negative.

Physical examination revealed only questionable tenderness in the left lower quadrant of the abdomen. There was no rebound tenderness. (The patient was quite apprehensive and pelvic examination had to be done under sodium pentothal anesthesia.) Pelvic examination showed: external genitalia normal; Bartholin's and Skene's glands normal; vaginal and cervical mucosa clean; cervix somewhat dusky in color but otherwise normal; uterus small, hard, anterior, and movable; right adnexa, small and hard, a mass, 2X3 cm., probably ovary, was palpated; the tube was not palpable, left adnexa contained a soft mass, 3X4 cm., close to the uterus which was thought to involve the tube.

<sup>1</sup> U. S. Naval Hospital, Bethesda, Md.

*Impression.*—Left ectopic pregnancy unruptured

Laboratory data Urinalysis was within normal limits, hemoglobin, 13 gm.; and red and white blood cell counts were within normal limits

*Operation.*—The abdomen was opened through the usual lower midline approach. The right tube and ovary had been removed surgically. The left tube and ovary were adherent to the sigmoid and the sigmoid was kinked on itself by an adhesion to the left tube. The tube and ovary were freed from the bowel and a mass, 2×3 cm., was found lying under a recto-uterine fold of peritoneum. A small piece of omentum adherent to this area was freed revealing a fixed mass underlying the peritoneum. There were no endometrial implants in the pelvis. An attempt was made to shell the mass out of the dome of the bladder where it seemed to lie, the bladder was entered because the mass apparently involved the bladder musculature. On opening the bladder the inner border of the mass, which contained numerous bluish cysts, could be seen lying submucosally. The first impression was that this was a neoplasm but the possibility that it was an endometrioma was also considered. The mass and a margin of bladder wall were excised. The bladder was then closed around a No. 1½ Foley catheter which was brought out through the lower end of the wound. The peritoneum was closed so as to extraperitonealize the evaginotomy wound and the abdomen was closed in layers. A Foley catheter was also placed in the bladder through the urethra and continuous suction was applied to both catheters for 7 days. The wound healed primarily and the patient left the hospital on 13 January 1949, 18 days postoperatively.

#### *Pathologist's report*

One surface of the specimen is covered by mucosa beneath which are numerous cystic structures averaging 0.3 cm. in diameter and which have a reddish brown color



Figure 1.—Endometriosis of the wall of the urinary bladder showing endometrial glands surrounded by endometrial stroma embedded in bladder musculature.



Figure 2.—High-power view of figure 3 showing fat and hemosiderin-filled macrophages in the cystic area.

**Microscopic examination.**—Sections of urinary bladder show small glandular structures deep in the muscularis. These are lined by cuboidal to columnar epithelium resembling that of the glands of the endometrium of the uterus (fig. 1). About these glands is a small amount of stroma consisting of densely packed hyperchromic ovoid cells. Those glands located toward the mucosa and beneath transitional epithelium are much larger and are lined by low cuboidal epithelium, and contain hemosiderin and fat-filled macrophages (fig. 2). The cellular response indicates old hemorrhage (fig. 3). Since the surface epithelium is intact, it is doubtful that hemorrhage occurred into the urinary bladder. In other areas there is dense fibrous tissue containing hemosiderin-filled macrophages, representing hemorrhage into stroma from ruptured glands with resultant scarring. The muscularis appears slightly hypertrophied throughout and the serosa is unremarkable.

**Diagnosis**—Endometriosis of urinary bladder.



Figure 3.—Low-power view of bladder mucosa with a cystic area into which old hemorrhage has occurred.

## DISCUSSION

There are four schools of thought as to the origin of endometriosis: (a) as a remnant of the wolffian (von Recklinghausen (3)) or Müllerian duct (Kossman (4)); (b) metaplasia from normal endothelial cells of the peritoneum, due to some hormonal or traumatic influence on the cells (Iwanoff (5)); (c) from normal endometrial tissue reaching aberrant positions as a result of direct extension (Cullen (6)), reflux of menstrual blood through the fallopian tubes (Sampson (7)), or by way of the lymph and blood vessels from the uterine cavity (Halban (8)); and (d) from derivatives of celomic epithelium (Waldeyer (9), Meyer (10), and Novak (11)). Each school of thought can produce cases to prove their theory and disprove the others so the question has yet to be settled.

Goodall (12) is a strong proponent of the third school. He believes there are two types of endometriosis depending upon the specific cell structure. The first type is called stromatous endometriosis because it comes from the stromal cells alone. The second type he calls the mixed type because it comes from the lining cells of uterine secretory glands and also has stromal cells present. As only the superficial layers of the endometrium respond to the monthly cycle, this holds for the ectopic cells as well. He indicates that there are three modes

of invasion of the bladder in the formation of an endometrioma. The first is direct, by lymphatic continuity or backflow from the deep uterine mucosa through the uterine wall. The second is indirect, from implants in the peritoneal vesico-uterine pouch and then into the muscularis and mucosa. The third is due to traumatic displacement of endometrial cells following surgery. He also divides bladder endometriosis into three groups. Group I is composed of cases of stromatous endometriosis and involves the trigone and base of the bladder derived directly from the deep layers of the uterine mucosa. Group II is composed of cases of involvement of the fundus from peritoneal endometriosis. The majority of these follow injury to the bladder at the time of surgery. Robert Meyer (13), in 1930, classified bladder endometriosis into three groups according to their origin: (a) internal endometriosis with origin probably from bladder epithelium; (b) external endometriosis with origin from serosal cells; and (c) collision endometriosis resulting from Groups I and II.

The case presented shows that there may be extensive involvement of the bladder without symptoms. However, this is a very rare occurrence in an uncommon disease entity. The classical picture is cyclic dysuria, urinary frequency, and hematuria. Hematuria associated with the menstrual period was present in only 13 of the 46 cases reported by Moore et al. (2). Urgency is usually associated with urinary frequency. Suprapubic pain with or without a menstrual period is also a common complaint. All the symptoms of pelvic endometriosis may be present and are an aid in the differential diagnosis. Relief of the symptoms during pregnancy is a good diagnostic sign, as is the cessation of the complaint with cessation of ovarian activity. The question of sterility is difficult to evaluate from the case reports in the literature, as that factor is usually omitted in the articles, but it is something to be aware of as possible diagnostic aid.

If endometriosis is suspected, cystoscopic examination should be done and, although a typical picture may not be present, the history and findings will usually indicate the correct diagnosis. Phillips (14) has an excellent series of colored plates demonstrating the typical cystoscopic findings.

The youngest patient was 18 and the oldest 48 years of age. The average age is between 35 and 39 years.

Keene and Kimbrough (15) in 118 cases of endometriosis, and Holmes (16) in 145 cases of endometriosis, each found bladder invasion in 2 cases.

The treatment of endometriosis of the bladder is dependent upon two things: the age of the patient and her child-bearing potentialities. If she is young and wishes to have children, then excision is

the treatment of choice, as the percentage of complete cures is very high. If the patient is approaching the menopause, irradiation of the ovaries to check ovarian activity is sufficient; regression of the lesion will follow and no further treatment is necessary. Castration by surgical means accomplishes the same end. Fulguration by the transurethral route is to be condemned according to Moore et al. (2).

If the patient is young and the lesion is too extensive for surgical extirpation or if the lesion is encroaching on the ureteral orifices, then the most effective treatment is castration.

The case reported presents several interesting features. At no time did the patient have any urinary complaints. Cyclic bladder complaints were present in 40 of the 46 cases reported upon by Moore et al. (2) and were present in every case reported since. Cystoscopic examination of this patient prior to surgery would have been interesting, but there was no reason to suspect bladder disease. It is unlikely that the vesico-uterine fold of peritoneum was damaged at the operation for ruptured ectopic pregnancy; however, in the series reported by O'Connor and Greenhill (17) of 58 cases of endometriosis of the bladder, 35 had had previous surgery; and the condition was most frequently seen following hysterectomy.

This patient had no other evidence of endometriosis.

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# Hutchinson-Besnier-Boeck Sarcoid

## Report of Three Cases and Review of the Literature

RICHARD FOULKE, Lieutenant, junior grade (MC) U. S. N.<sup>1</sup>

SAMUEL L. MOSCHILLA, Lieutenant, junior grade (MC) U. S. N.<sup>1</sup>

THE word sarcoid was derived from the two Greek roots meaning "flesh" and "form." Boeck (1) called the disease sarcoid because he believed the histological picture resembled the small cells of sarcoma.

### HISTORY (2)

In 1869 Hutchinson described the first case of skin involvement but failed to name the disease. In 1889 Besnier described lupus pernio and called it "Mortinier's malady" (after the patient's name). In 1889 Boeck described the disease and its histology under the title multiple benign sarcoid; later he called it "benign miliary lupoid." In 1902 Kienbock described the cystic bone changes but believed syphilis to be the cause. In 1915 Kutzinsky and Bittorf described the pulmonary lesions and correlated the skin with the lung lesions. In 1917 Schaumann integrated histologically the skin and lymph node lesions. In 1932 Kissmeyer summarized the previous contributions and added a few of his own. In 1936 Schaumann reported his 20 years of observation of the disease. In 1937 Longcope and Pierson (3) stimulated American interest in this disease.

### CLINICAL ASPECTS

Sarcoidosis is usually a benign systemic disease involving the reticulo-endothelial system. This is a disease of the second and third decades with no sex predilection but with a greater incidence in the American Negro. The predominance of certain visceral involvement led to the description of several clinical entities.

Skin lesions appear in about 50 percent of patients with sarcoidosis. Some authors (4) (5) claim that when complicating visceral tuberculosis occurs the skin lesions may disappear.

<sup>1</sup> U. S. Naval Hospital, Philadelphia, Pa.

There are several specific dermatological manifestations of this disease:

(a) The Boeck-type (1) occurs most frequently in women. The areas involved include the face, especially the nose, mouth, and eyelids, the back of the shoulders, and the extensor surfaces of the arms. The lesions are papules, nodules, or infiltrating plaques; annular or gyrate. They are firm, elastic, round, and brownish-red. Occasionally telangiectases and superficial scaling occur. Sometimes under pressure the nodules seem to be composed of grayish-yellow foci which suggested to Boeck "miliary lupoid." When the lesions disappear atrophic pigmented areas remain.

(b) Lupus pernio (6) (7) is confused with chilblain lupus (Hutchinson), a type of discoid lupus erythematosus. The lesions are bluish-red, infiltrated, and in symmetrically placed plaques. The areas involved are the nose, ears, forehead, dorsal surfaces of the hands, and occasionally, the toes. Telangiectatic vessels are usually present over the surfaces of the lesions. The phalanges are often involved and present a fusiform deformity.

(c) The angiolupoid type was described by Brocq and Pautrier (8) in 1913 (7). The lesions are nodules and plaques; bluish-red occasionally tinged with yellow, and there are numerous telangiectatic vessels over their surfaces. They are located on the sides of the nose, inner ocular canthus, and cheeks.

(d) Erythrodermic type of sarcoid was described by Schaumann (9) in 1924. This form appears as large serpiginous, red scaling, noninfiltrating areas on the front of the legs and thighs. Pantrier described erythrodermia of this type associated with lupus pernio of the face.

Nonspecific eruptions such as prurigo and urticaria may be present. Erythema nodosum may also be associated with this condition.

(e) In 1906 Darier and Roussy (10) (11) described a type of sarcoid. The lesions consisted of painful nodules in the hypodermis in areas of adipose tissue. They sometimes occur in chains following the blood vessels. This causes confusion with erythema nuduratum which some authors believe to be a sequela of this type of sarcoid. The lesions are limited to the trunk and lower limbs. They vary in size from a bean to a walnut and in color from that of normal skin through different shades of red. Occasionally they flatten out to form plaques. They are usually numerous, never ulcerate, or metastasize and, when they subside, fibrosis may result. This type of sarcoid is now being recorded more frequently with the Boeck type.

There are two skin diseases which have frequently been erroneously classified as cutaneous sarcoid. These are the sarcoid-type of tuberculosis of the American Negro and the sarcoid of Spiegler-Fendt.

Nomland, Crawford, Klauder, and Thomas (12) believe that the sarcoid-type of tuberculosis of the American Negro is tuberculosis of the skin of hematogenous origin which assumes sarcoid features due to an unusual immunological reaction on the part of the patient. Thomas presented 11 cases illustrating five main types of cutaneous lesions. The superficial lesions, which on healing left atrophic scarring, resembling discoid lupus erythematosus. The small papules about the eyes, nose, and mouth resembled psoriasis. There were brownish indurated plaques assuming annular configuration with central atrophy. The nodular ulcerative lesions on the legs resembled, in appearance and course, those of erythema induratum. There were also subcutaneous cherry-sized nodules on the body. Reisner (13) described cutaneous tuberculosis in the American Negro as having the following characteristics: sarcoid-type of skin lesions; skin histologically on a borderline between sarcoid and tuberculosis; positive tuberculin test; and, in some patients, subsequent caseous tuberculosis in various viscera.

The sarcoid of Spiegler-Fendt actually is lymphosarcoma. Spiegler and Fendt realized that they were not dealing with sarcoma and called the lesions a type of "sarcoid." In 1935 Lewis (14) reviewed the literature and summarized his impressions. There are two types of lesions: the localized superficial benign type, which may disseminate; the lesions are few in number, tend to be grouped, appear in any part of the body, and resemble the miliary sarcoid of Boeck; the disseminate type has varying numbers of nodules, plaques, and tumors which vary from the color of skin to reddish-blue, occur anywhere on the cutaneous surface, and may involve any organ of the body. All of these types are histologically reticular cell lymphosarcoma. The outcome in the disseminate type may be unfavorable. There is an absence of the clumping of the naked nuclei of granuloma fungoides, of intracellular nuclear proliferation of lymphogranulomatosis, and of the Dorothy-Reed cells of Hodgkin's disease.

The diagnosis of systemic sarcoidosis is made from the clinical picture, radiological examination of the chest and small bones, anergic reaction to high concentrations of tuberculin, absence of tubercle bacilli in involved areas, and skin biopsy. The signs and symptoms depend on the organs involved. There may be fever (unusual), generalized malaise, fatigue, and weight loss. The skin, eyes, salivary glands, lungs, bones, and lymphatic system are the more common sites of involvement; however, hypophyseal (15), tonsillar (9), laryngeal, breast, cardiac (16), intestinal, pancreatic, and testicular infiltrations have been described.

Uveoparotitis was described in 1909 by Heerfordt (17). He designated the inflammation of the parotid gland and the iris as a localized type of sarcoid. This phase of sarcoidosis occurs in about 10 per cent.

Other salivary glands may be involved. Fever may precede or accompany the early stages. The firm and painless swelling of the parotid gland usually precedes the ocular involvement. The inflammation of the parotid gland is confined to the capsule and may persist from 2 to 6 months. The uveitis is the most common ocular lesion; however, corneal herpes, corneal opacities, vitreous hemorrhages, optic neuritis, chorioretinitis, glaucoma, nodular conjunctivitis, and infiltration of the adnexa have been described (18). In one-third of the cases facial nerve paralysis occurs, and in one-half of these cases it is bilateral. Erythema nodosum or toxicum has been described as accompanying some of these cases. This disease has been classified under Mikulicz's syndrome because symmetrical lacrimal and parotid gland involvement has been described.

In 1924 Martenstein (19) found the roentgenographic incidence of hilar involvement to be about 31 percent. He described the characteristic roentgenographic lesions to be enlarged hilar nodes, atelectasis, chronic interstitial fibrosis, and the "ground glass effect." King (20), and Bernstein and Sussman (21) have described the roentgenographic chest findings. Leitner, Bernstein, and Sussman (21) and Rubin (22), classified the roentgenographic features into phases for descriptive purposes, but one must remember the lung changes are not static and that the pulmonary picture is usually changing from one phase into another. Three phases of pulmonary involvement are described. The hilar phase is the most common and can usually be seen in a chest roentgenogram. The hilar lymphadenopathy, which is usually bilateral and symmetrical, involves both peribronchial and right peritracheal nodes. The transitional phase develops with diminution of hilar lymphadenopathy and the infiltration of the adjacent parenchyma. The process, unlike tuberculosis, spreads to the middle and lower lobes. In erythema nodosum similar hilar adenopathy has been described but the skin lesions and the course of the thoracic lesions are important differential points. The parenchymal phase is characterized by reticulation, stippling, or marbling. Infiltration is greatest in the middle and lower lobes. This phase poses roentgenologic diagnostic problems. The reticulation resembles lymphangitic carcinoma; the stippling resembles hematogenous tuberculosis; and the marbling resembles metastatic carcinoma. The pleura is often involved but pleural effusion is rare unless there is the complication of heart failure or active tuberculosis. With massive parenchymal involvement, this disease can resemble any fibrosing or ulcerating lung disease but the roentgenologic picture is out of proportion to the patient's symptoms.

In 1934 Nielsen reported the incidence of bone lesions to be 20 percent. Schaumann (5) believed that the marrow is the starting point

of sarcoidosis. In 1919 Jingling called the lesions "osteitis tuberculo-sa multiplex cystoides." In 1931 Kirklin and Morton (23), and in 1938 Ellis (24) described the lesions accurately. The two pathologic findings are a thickening of the trabeculae and clear cystic changes. The phalanges of the hands and feet are almost always involved. Skin lesions are usually present. The lesions occur predominantly in young adults. There is no sinus formation, sequestration, joint, or periosteal involvement. The lesions must be differentiated from tuberculous or syphilitic dactylitis, blastomycosis, chondromatosis, and osteitis fibrosa cystica.

Boeck noted the lymphadenopathy in his original description. Schaumann (5) described this disease as an affection of the lymphohematopoietic system exhibiting lesions of the cutaneous and visceral lymphatic structures.

Of the cases of sarcoidosis about one-third to one-half will undergo spontaneous healing. In the remaining half, 50 percent may become chronic and show organic involvement of irreparable nature and the other 50 percent may develop tuberculosis. As Rubin and Pinner (25) stated the benign nature of this disease has been overemphasized. The causes of death in sarcoidosis are complicating tuberculosis, dysfunction of vital organs through invasion, pulmonary infarction, and widespread amyloidosis.

Consideration of the differential diagnoses must include the following:

<i>Skin disease</i>	<i>Systemic disease</i>
Nodular-type of discoid lupus erythematosus	Tuberculosis.
Erythema induratum	Hodgkin's disease.
Hodgkin's disease of skin	Deep fungus infections: Coccidioidomycosis. Aspergillosis.
Nodular tuberculosis	Chemical granulomatoses: Berylliosis. Silicosis. Asbestosis.
Mycosis fungoides	Syphilis.
Leprosy	Leprosy.
Syphilis	Gonorrhea
Neurofibromatosis	Gout.
Leukemia cutis	Lymphatic leukemia.
Lymphangioma cutis	Lymphosarcoma.
Multiple lipomas	Metastatic carcinoma

#### ETIOLOGY

Most investigators believe the etiologic factor to be a reaction of immunity to the tubercle bacillus or its products. Darier classified Boeck's sarcoid with the tuberculids. Pinner (4) believes that sarcoid is noncaseating tuberculosis and that the noncaseating lesions may

undergo caseation. Reinstierna and Filho (26) believe that the whole picture can be produced by leprosy. Schumann (5) believed the bovine bacillus to be responsible. Snapper advanced a virus as the cause. Kveim made an antigen from lymph nodes of patients with sarcoid thinking that sarcoidosis might be a virus disease like lymphopathia venereum. He believed his skin test to be as specific and allergic as the Frei test; however, the usefulness of the test is hindered because of lack of standardization and the occasional slow response to the test.\*

In view of the failure of animal inoculation, the problem is to explain the negative tuberculin test. Sulzberger (27) found that in persons with sarcoidosis the tuberculin test was negative more often than in healthy persons. Leder (28) and others explain the anergic state as a specific alteration in the capacity of tuberculous patients to react to tuberculin. In 1921 Mantestem advanced the idea that the negative tuberculin test in those patients resulted from the presence in the blood serum of tuberculin neutralizing factors known as "antitubercins." Pinner, Weiss, and Cohen demonstrated the presence of "antitubercins" in the serum of 5 percent of normal and tuberculous patients, and in 36 percent of the patients with sarcoidosis. The presence of "antitubercins" in sarcoid was found less frequently than the negative tuberculin test. Other authors have not been as successful in demonstrating these "antitubercins."

#### HISTOLOGY

The basic histologic lesion is the "hard tubercle." Under the microscope one sees a uniform and monotonous picture. The characteristic lesion is a circumscribed collection of epithelioid cells with a few scattered Langhans-type of giant cells and a lack of lymphocytic response. Central necrosis or caseation is always absent. The microscopic picture of sarcoid must be differentiated from that of tuberculosis. Caseation or polymorphonuclear response of tuberculosis does not occur in sarcoid. The giant cells of sarcoid differ from those of tuberculosis in that they are larger, more nucleated, seldom arranged in elliptical manner, and contain Schaumann's inclusion bodies. A greater uniformity of proliferative type of tissue response is seen in sarcoid. The lesions of the liver, when involved in sarcoid, occur in the portal triad with only a few in the midzones of the lobules while the reverse is true when the liver is involved in tuberculosis. Unlike tuberculosis, the reticulum is not destroyed in sarcoid.

#### LABORATORY DATA

Harrell and Fischer (29) have reported hyperproteinemia, hyperglobulinemia, increased blood calcium and phosphatase in the active

\* It may sometimes take as long as 6 months for a positive Kveim test to develop.

cases; the blood chemistry values become normal when the lesions heal. Reisner (13) stated that monocytosis occurs more frequently in the early or the disseminating phase. There is usually an eosinophilia and an elevated sedimentation rate which will persist even in the asymptomatic chronic phase. A false positive blood Wassermann test is found occasionally. In nveoparotid fever there may be a pleocytosis and an increased protein in the cerebrospinal fluid. Other changes in the blood picture and chemistry may result from the infiltration of vital organs such as massive pulmonary involvement with secondary polycythemia.

#### TREATMENT

The treatment of this disease is at best palliative and symptomatic. In the generalized type, arsenic has been used, but the hazard of large doses over long periods of time must be recognized. High voltage roentgen therapy has proved beneficial occasionally for the skin lesions, but it is of questionable value for systemic involvement; Pohle, Paul, and Clark (30) had favorable results in 8 of their 14 cases with hilar adenopathy. They had no therapeutic complications and advocated further use for true clinical evaluation. *Lupus pernio* is best treated with intensive applications of carbon dioxide. Gold, sodium thiosulfate, bismuth, tuberculin, and chaulmestrol have been used with no remarkable or consistent results. Curtis, Taylor, and Grekin (31) have reported favorable results from the oral administration of eal-eiferol and dihydrotestosterone, working on the theory that increased excretion of phosphorus might affect the phospholipids.

#### CASE REPORTS

*Case 1*—A V., a 23-year-old Negro, was first seen in the out-patient clinic on 3 August 1948 complaining of dyspnea on exertion for 5 weeks. The patient had noted an increase in the dyspnea since 20 July 1948 when he developed an upper respiratory infection with a productive cough and greenish-yellow sputum.

A chest roentgenogram (fig. 1) showed a roughly rounded area of increased density extending from the right upper paravertebral area toward the right hilum in the region of the fourth, fifth, and sixth posterior interspaces and lying above the right first rib and upper border of the right second rib to the right of the midline. The lateral view showed the area of density to be in the anterior portion of the superior mediastinum without displacement of the trachea and esophagus. The remainder of the lung fields were clear. It was thought that the new growth of the mediastinum was probably of the lymphoblastoma group.

The patient was admitted to the Naval Hospital, Philadelphia, for further study on 10 August 1948. On admission his complaints were substernal pain, which began 7 August 1948, dyspnea on exertion, and a productive cough with greenish-yellow sputum.

The past and family histories were noncontributory.

*Physical examination*—The patient was a Negro in no apparent distress. His eyes, ears, nose, and throat were normal. There were several small lymph nodes which were nontender, not fixed or discrete in the right axilla, both right



Figure 1

and left inguinal regions, and left suprACLAVIcular fossa. Examination of the lungs and heart revealed no abnormalities. Blood pressure was 130 systolic and 70 diastolic. Examination of the abdomen, genitalia, and extremities was essentially negative.

Bed rest and a regular diet was prescribed. On 20 August 1948 a biopsy of a lymph node from the left suprACLAVIcular fossa was suggestive of sarcoidosis but tuberculosis could not be ruled out. A second biopsy of the right axillary node on 30 August 1948 when compared with the previous biopsy indicated sarcoidosis. Chest roentgenograms during hospitalization revealed no change from the previous films. Roentgenograms of the hands and feet revealed no rarefaction of bone.

Tuberculin test, blood Kahn test, and urinalysis were negative. Red blood cell count, 4,200,000; hemoglobin, 13 gm; white blood cell count was 4,700, and the differential was normal. The blood calcium, total serum protein, albumin, and globulin were normal.

The patient's course in the hospital was uneventful and his symptoms disappeared almost entirely with symptomatic therapy. The final diagnosis was sarcoidosis involving the paratracheal nodes and the subcutaneous lymph nodes.

**Case 2—S. H.**, a 24-year-old Negro was admitted on 22 June 1948 complaining of dyspnea on exertion. He had no complaints until January 1948 while in the Army, at which time he had a cough, expectorating small amount of white mucus and moderate dyspnea. In February 1948 a chest roentgenogram showed lesions suggestive of tuberculosis, as a result, he was hospitalized. Studies at that time were negative for tuberculosis. He was discharged from the hospital

and from the Army after several months hospitalization. Sarcoidosis was the tentative diagnosis.

By November 1947, the dyspnea and cough had increased and he was again hospitalized. At that time chest roentgenograms revealed some increase in the pathologic lung changes with suggestion of cavity formation; the lesions were diffusely scattered throughout both lungs. Studies for evidence of tuberculosis were again negative. No positive results were obtained from tests for fungus disease. Bronchoscopy examination revealed no abnormalities. A biopsy of an enlarged lymph gland showed lymphadenitis. After several months he was discharged from the veterans' hospital with a tentative diagnosis of sarcoid disease.

The patient's symptoms continued. He had progressive weakness, weight loss, night sweats, and occasional chest pain. He was again hospitalized in June 1948, as he had lost 10 pounds in the previous 3 months and was unable to work. Treatment gave him no relief.

On admission in June 1948; the patient was a poorly nourished Negro and was in only slight distress. The positive physical findings were signs of consolidation throughout the right lung field and the upper portion of the left lung. There were several small discrete lymph nodes in the right supraclavicular region. No other abnormal findings were noted. His temperature ( $98.6^{\circ}$  F.), pulse rate (96), respirations (18), and blood pressure (120/80) were normal.

Röntgenograms of the chest (fig. 2), showed the entire right lung field up to the apex to be almost obliterated by patchy areas of homogeneous densities.



Figure 2.

The upper left and left midlung fields were also obscured by similar patchy areas of homogeneous density, but the parenchymal markings were visible. There was no evidence of abnormality in the region of the heart or great vessels.

White blood cell count on admission was 7,100; differential count showed 10 young and 62 old polymorphonuclears, 18 lymphocytes with 10 monocytes. Red blood cell counts, 4,200,000 with a hemoglobin of 9 gm. The urinalysis and blood Kahn test was negative. Repeated gastric washings and sputum analysis revealed no tubercle bacilli or fungi on smear or culture. Skin tests for tuberculosis, coccidioides and histoplasmosis showed no reaction. Sedimentation rate was 21 mm. in 30 minutes (Cotler) with a maximum of 5 mm. in 5 minutes, this remained elevated throughout hospitalization. The blood calcium, total serum protein albumin, and globulin were within normal limits.

It was thought from roentgenographic findings and the past medical history, that the patient might have active tuberculosis. However, roentgenographic findings were also compatible with sarcoidosis. During his course in the hospital, his temperature ranged from 98° F to 102° F with no accompanying increase in pulse rate. With bed rest and symptomatic therapy improvement was noted. Repeated roentgenograms and physical examination showed no change.

On 2 September 1948, a supraclavicular lymph node, 10 mm. in diameter, was removed for biopsy. On cut section it was grayish-pink, and histological examination revealed tissue characteristic of Boeck's sarcoid.

The patient was thoroughly examined for other evidence of sarcoid by an ophthalmologist and a dermatologist. No abnormalities were noted. He was discharged on 10 September 1948 with orders to return for periodic chest roentgenograms and physical examinations to determine the status of the sarcoidosis. Some dyspnea on exertion still persisted at the time of discharge.

**Case 2—J. M. B.** A 25-year-old white man was admitted on 15 March 1948 for study. Routine chest roentgenogram taken on 10 March 1948 (fig. 3) at his place of employment revealed an extensive mediastinal mass with widespread scattered areas of soft density throughout the upper chest, bilaterally. A chest roentgenogram taken on 20 January 1947 had been reported as negative. Apparently the patient had been perfectly healthy until January 1944 when he first complained of pain in the upper lumbar region bilaterally which radiated anteriorly along the lower costal margin. This pain lasted 1 week and had recurred several times. The patient had lost 10 pounds since the onset of the pain. Progressive weakness was noted in this same period. No dyspnea, cough, or other symptoms referable to the lungs were present.

Past and family histories were non-contributory.

Physical examination on admission revealed a tall, well-developed white man weighing 170 pounds. The ears, eyes, nose, and throat were essentially negative. Examination of the chest revealed no abnormal findings. The liver and spleen were not palpable and there was no tenderness in the abdomen. The genitalia and extremities



Figure 3.

were normal. No lymphadenopathy was noted. His blood pressure, pulse rate, temperature, and respirations were normal. At this time it was thought that the mediastinal mass could be Hodgkin's disease, sarcoid, metastatic carcinoma, or tuberculosis.

Studies were begun to make the correct diagnosis. White blood cell count, 5,700 with a normal differential. Red blood cell count, 4,500,000 with hemoglobin 13 gm. Urinalysis and the blood Kahn test was negative. The total serum protein, albumin, globulin, and blood calcium was within normal limits. The sedimentation rate was slightly elevated. The tuberculin test was negative in 1:100 and 1:1,000 dilution.

Roentgenograms of the chest were compatible with sarcoidosis. Roentgenograms of the hands and feet were negative. An intravenous pyrogram was within normal limits. An incidental finding at that time was spina bifida occulta of the first sacral segment with moderate demineralization of the lumbar spine.

Bronchoscopic examination on 1 April 1948 showed the carina to be greatly deformed and broadened. The entire area at the angle of the main bronchi was distorted and the lumen narrowed. It was thought that this was caused by a smooth swelling in the region of the mediastinum apparently spreading the bronchi. Papanicolaou stain of bronchial secretions was reported as negative for tumor cells.

No positive diagnosis could be established after the completion of the studies. It was believed that the patient's condition was probably Hodgkin's disease or sarcoidosis. He was seen by a group of consultants who thought that high voltage roentgen therapy to one side of the chest should be given to see the effect on the mediastinal mass and the lung. Dosage was to be 100 roentgen anteriorly and posteriorly to the right hemithorax on a 15 by 15 cm field, and this was to be given at monthly intervals for 4 months and then a free interval of 4 months was to be allowed to lapse before a possible second course was to be instituted. This therapy was begun on 18 April 1948. He had made clinical improvement on symptomatic therapy and bed rest. There were no changes in the physical findings or chest roentgenograms on discharge.

The patient continued working while receiving therapy, until 9 August 1948, when he had an acute gastroenteritis. He was admitted to the hospital on 13 August 1948, still complaining of anorexia and vomiting. Vague lumbar pain had persisted since his previous admission. Physical examination at this time revealed no change from his last admission except for some mild epigastric tenderness. With diet and symptomatic therapy he soon recovered from this acute gastrointestinal upset.

On admission white blood cell count was 15,000 with an increase in polymorphonuclears; this was normal in 1 week. Tuberculin tests were still negative. Other laboratory tests were within normal limits.

A chest roentgenogram (following the last high voltage roentgen therapy) on 21 August 1948 showed a considerable decrease in the bilateral peribronchial



Figure 4.

density and adenopathy and the soft nodular involvement of the apical regions (fig. 4). Roentgenograms of the bones of the hands and feet revealed no change.

On 3 September 1948, a small discrete lymph node was noted in the right supraclavicular region. On 10 September 1948 a biopsy showed histologically typical Boeck's sarcoid. With the diagnosis established, the patient was discharged to be checked at frequent intervals by chest roentgenograms and physical examinations.

#### SUMMARY

Three cases illustrating sarcoidosis involving the lungs and peripheral lymph nodes are presented; the diagnosis in each of these cases was confirmed by lymph node biopsy although the condition was suspected following chest roentgenograms. Sarcoidosis can involve almost any organ in the body and can present many different signs and symptoms, and should be kept in mind when making a differential diagnosis in certain symptom complexes.

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# Carcinosarcoma of the Uterus

## Report of a Case

ALAN RAFTERY, Lieutenant (MC) U. S. N.<sup>1</sup>

EWING (1) devotes a section of his discussion of types of sarcoma to carcinosarcoma of the uterus, emphasizing errors in interpretation. In 1938, Saphir and Vass (2) reviewed 36 cases of carcinosarcoma occurring in the uterus and did not believe any of these to be true coexisting carcinoma and sarcoma, pointing out the common sources of error in interpretation. Since that review 2 cases have been reported in the English literature (3) (4). The following case is reported not only because of the rarity of the condition, but also to point out an error in interpretation, the antithesis of those emphasized in the references previously mentioned.

### CASE REPORT

A 52-year-old white woman was admitted in January 1948 complaining of slight vaginal bleeding of 3 months' duration. Cytologic study of vaginal smear showed malignant cells, probably of endometrial origin (fig 1). Tissue obtained by uterine curettage showed adenocarcinoma of the endometrium (fig 2).

She received 5,000 mg hours of radium by intrauterine application. Six weeks following the completion of radiation a total hysterectomy was performed. The uterus showed a necrotic, boggy, papillary mass, 3.0×2.5×2.5 cm attached by a short pedicle, 1.2 cm in diameter, to the endometrium in the center of the anterior uterine wall. Sections from this mass and the adjacent uterine wall showed a few nests of degenerative appearing epithelial cells embedded in degenerative stroma. The base of the stroma was cellular with extreme inflammatory cell infiltration and the stromal cells showed considerable radiation effect. The postoperative course was uneventful and the patient was discharged.

In August 1948 she was readmitted complaining of a recurrence of vaginal bleeding. On examination, a large soft hemorrhagic mass was found in the vaginal vault; on biopsy this was found to be an anaplastic sarcoma. At this time sections of the original specimen and others from the uterus were carefully reviewed. The stromal reaction noted in the original report was interpreted at this time as sarcoma and the diagnosis was changed to carcinosarcoma of the uterus.

The tumor in the vaginal vault did not respond to high-voltage roentgen therapy and progressively enlarged. Her course was steadily downhill; partial bowel and ureteral obstruction and a rectovesicovaginal fistula occurred and the patient died 9 January 1949.

<sup>1</sup>U. S. Naval Hospital, Bremerton, Wash.



Figure 1.—Malignant cells in original vaginal smear.  $\times 400$ .



Figure 2.—Original endometrial biopsy.  $\times 250$ .

At autopsy the pelvis was found to be filled with a huge necrotic tumor mass that involved the pelvic structure and displaced the urinary bladder. The rectum and bladder opened into a cavity 22 cm. in circumference lined on one border by recognizable vaginal mucosa. Numerous sections taken from the mass showed a picture of anaplastic sarcoma characterized by cellular pleomorphism, lack of differentiation, and broad areas of necrosis (fig 3). A single tumor nodule, in the lower lobe of the right lung was found; histologic examination showed a well-differentiated metastatic adenocarcinoma, resembling the adenocarcinoma of the uterus seen in the first biopsy (fig 4).

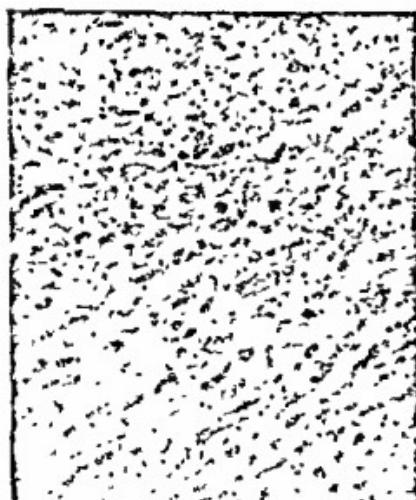


Figure 3.—Pelvic sarcoma at autopsy.  $\times 250$ .



Figure 4.—Metastatic adenocarcinoma, lower lobe, right lung.  $\times 125$ .

## COMMENT

It is believed that the intrauterine carcinoma was controlled by the initial radium therapy, but the radioresistant sarcoma survived and gave rise to the "dropped" metastasis in the vaginal vault. The pulmonary metastasis probably occurred prior to instituting therapy.

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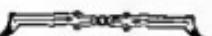


**AN ARTIFICIAL HEART OR CARDIOPULMONARY MACHINE; Performance in Animals.** by V. O Bjork. From the Surgical Clinic of Sabatsberg Hospital, Stockholm, Sweden. *Lancet* 2: 491-493, Sept. 25, 1948.

Bjork reports that in 1935 Crafoord found that it was possible to suspend the flow of blood to all the organs except the brain for a considerable period of time without damaging them. In 33 patients undergoing operation for patent ductus arteriosus he double clamped the aorta just below the point where the left subclavian artery arises for from 10 to 27 minutes without producing any disturbance in the internal organs of these patients.

In 1940 Crafoord and Anderson constructed an artificial heart which Bjork used in the dog. He clamped both the inferior and superior venae cavae for 30 minutes rendering the heart bloodless but maintaining the blood flow to the brain with the artificial heart. The dog survived with no evident signs of organic damage. They state that in order to perform a bloodless intercardiac operation it is only necessary to maintain an adequate circulation of oxygenated blood through the brain and to provide for maintenance of the blood concentrates within normal limits.

The apparatus consists of a horizontal cylinder containing a partition trough in the lower part of the cylinder. The blood flows alternately over successive partitions and through the cylinders; runs a central axle bearing 40 to 50 rhodium plated stainless steel disks which dip into the blood and as they rotate expose films of blood to the oxygen in the cylinder.—Abstract.



# Disinsertion of the Biceps Brachii

## Report of a Case

JOHN S. THIEMEYER, JR., Commander (MC) U. S. N.<sup>1</sup>

**D**ISRUPTION of the continuity of the biceps brachii muscle is common among persons such as laborers and athletes, and others performing strenuous muscular exertions. Commonly, the disruption occurs in the continuity of the long head.

Gilerest (1) reported a series of 100 cases in which rupture in 20 occurred in the upper musculotendinous junction and in 56 involved the long head directly as follows: rupture of long head, complete in 3; rupture of long head, partial in 5; rupture of tendon of long head (intra-articular portion) in 34; and rupture of tendon of long head (extra-articular portion) in 14. There were also 2 with rupture of lower musculotendinous junction; 1 with rupture of lower tendon itself; and 3 with rupture of lower tendon, lower attachment.

Thus, there were only 6 cases in which the lower tendon was involved and only 3 cases in which the lower attachment was involved.

Watson-Jones (2) states "although the distal tendon is exposed to similar muscle strains, it is not subject to pathological degenerative changes and less than 40 cases of ruptures or avulsion have been recorded."

Milek (3) reported a case of "disinsertion of the biceps brachii" in April 1948 which presented the typical "lumping" of the muscle at the upper arm which occurs in disinsertion of the distal portion of the muscle. This case was operated upon and the muscle reinserted by means of a fascial graft.

### CASE REPORT

A. J. P., a 43-year-old man, had pain of the right arm following lifting of a heavy table. A "tearing" sensation occurred at the same time and the patient felt as though he had "torn his shirt." Upon looking at his arm he noticed the "muscle all bunched up" at the upper end of his arm and he became alarmed.

His past and family histories revealed no significant findings and a complete blood count and urinalysis was within normal limits. The blood Kahn

<sup>1</sup> U. S. Naval Hospital, St. Albans, Long Island, N. Y.



*Figure 1.—Depression above the antecubital fossa and massing of the biceps muscle in the anterior-superior arm. This photograph taken when patient was anesthetized does not show the marked "bunching" of the muscle which was seen on admission.*

an "annoying" sensation but not a painful one and a firm, freely-movable mass about the size of a 25-cent piece, which was believed to be the distal end of the biceps tendon was palpated at the distal pole of the mass. At surgery this proved to be the case.

Shoulder motion was full and painless in all planes.

Surgery was performed the following morning. Under a pneumatic tourniquet a bayonet or Z incision was made with the proximal arm along the medial surface of the arm, the transverse arm crossing the antecubital fossa and the distal arm along the upper one-third of the lateral forearm.

Upon dissecting through the sheath of the biceps brachii proximally, a moderate semiorganized blood clot was encountered and the muscle itself was seen to be moderately hemorrhagic and retracted. The distal tendon was pulled in the lower pole of the sheath cavity and was found to be freely movable. A clamp was placed over the end of the tendon and it was withdrawn from the wound (fig. 2).

Dissection was then carried down into the forearm and the site of attachment of the biceps brachii to the ulna was exposed, showing an irregular, fibrous tissue surface from which the tendon had become disintegrated. A drill hole was passed through the ulna at this point and the biceps tendon passed down through the tunnel and secured to its normal insertion by No. 1 braided silk sutures. In addition several silk No. 00 sutures secured the tendon to the periosteum. The frayed tissue of the remnants of the tattered fibers were sutured together. The wound was then closed in an atraumatic manner and an ace bandage and sheet wadding dressing applied from knuckle-line to upper arm. Over this dressing a posterior molded splint was placed with the elbow in maximum flexion.

The patient remained in the posterior splint for a period of 1 month following which progressive return of function was carried out.

test was negative. Roenigenograms of the entire arm and forearm showed no evidence of pathologic bone changes.

**Physical examination.** The patient was a robust, well-muscled, white man not appearing in acute distress. The right arm showed massing of the biceps muscle in the anterior-superior surface of the arm with a definite depression above the antecubital fossa (fig. 1).

Flexion and extension at the elbow joint was full actively but flexion was weak and painful against resistance. Active pronation and supination were weak, although nonpainful.

Palpation of the muscle mass elicited

a "narrowing" sensation but not a painful one and a firm, freely-movable mass about the size of a 25-cent piece, which was believed to be the distal end of the biceps tendon was palpated at the distal pole of the mass. At surgery this proved to be the case.

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The patient remained in the posterior splint for a period of 1 month following which progressive return of function was carried out.



*Figure 2.—Surgical exposure of disinsertion of the biceps brachii from the ulna insertion.*

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**INTRA-ARTERIAL BLOOD TRANSFUSION.** by Sam F. Seeley, *Colonel, MC, U.S.A.* *American Journal of Surgery* 78: 733-735, Nov. 1949.

One of the most important considerations in the prevention of shock or the treatment of circulatory collapse is the appraisal of the disparity between vascular volume and the capacity of the vascular system. Because of the difficulties encountered in estimating the degree of depletion of the vascular volume, work on the intra-arterial administration of blood was begun in 1939. If a reservoir containing blood is attached to a major artery the supply of blood from the reservoir may be regulated to maintain normal blood pressure and to replace blood loss from hemorrhage.

Blood has been administered by way of the aorta, femoral, dorsalis pedis, brachial, and radial arteries. No damage to the arteries has been reported as a result of insertion of the needle. The hazard involved in the administration of blood of low oxygen content within an artery in the distal extremity may be overcome either by oxygenation of the transfused blood or by the introduction of a catheter of sufficient length into the radial artery to deliver the blood at or near the aortic arch. Attempts to oxygenate blood so far have not been successful. Arterial administration of blood is of value in (a) replacing rapidly large quantities of blood in cases of severe hemorrhage; (b) replacing sufficient blood to maintain blood pressure levels in cases of concealed hemorrhage; (c) maintaining normal blood pressure levels in the presence of impending collapse caused by trauma or hemorrhage so that surgery may be performed promptly when indicated; (d) perfusing patent coronary vessels at a blood pressure of any desired level, in cases of coronary infarction; (e) reducing blood pressure, to any desired level consistent with tissue oxygenation, during the stage of operation where serious hemorrhage may be expected with the subsequent return of blood to the circulation after the stage of danger has passed; and (f) producing a blood pressure level in the distal aorta equal to that of the proximal aorta prior to the release of clamps after resection of the aorta in cases of coarctation.—*Abstract.*



# Tetraethylammonium Chloride in Pain

VICTOR M. SHOLOH, M.D.  
LEWIS W. BLUMMLE, JR., Captain, MC U.S.A.

PAIN following needle aspiration of material for liver biopsy has not seemed to be a serious complication nor a contra-indication to the use of this diagnostic method. Nevertheless, pain of various intensities is reported to follow removal of a specimen for liver biopsy in as many as 80 percent of cases (1). This is particularly true when the transthoracic approach is used. Indeed, this has led many clinics to the routine use of demerol or morphine as a preoperative measure to minimize possible discomfort to the patient (2). Since the patients selected for liver biopsy are likely to be overly sensitive to opiates or barbiturates, it is desirable to use other means of analgesia, particularly in the small group of patients who experience severe pain following the operative procedure.

At the Army Hepatic and Metabolic Center specimens for liver biopsy are obtained through the thorax with the Vim Silverman needle. In this series three sites of pain have been noted even with the use of demerol preoperatively. First, pain in the epigastrum or right upper abdominal quadrant may be noted immediately with insertion of the needle. This has been described as dull and usually lasts about 2 hours, but may persist for a longer period. It may be associated with nausea lasting for a few minutes to 2 hours. This pain, even when persistent, is usually a source of only mild complaints by the patient. Second, a rather common and distressing pain has its onset from a few minutes to an hour following needling. This is a sharp, shooting, plemitic pain aggravated by inspiration. It is usually located at the site of needle insertion and may radiate through to the back or upward to the right shoulder and when present the patient's breathing is shallow and he splints his right hemithorax. This pain may be so severe that the patient is able to speak only in a

<sup>1</sup> Armed Forces Epidemiological Board

<sup>2</sup> Valley Forge General Hospital, Phoenixville, Pa.

grunting manner and he becomes extremely apprehensive because of his inability to fill his lungs with air. It is this type of pain for which some form of relief is desirable. The third and least common site of pain in this series has been the right shoulder pain; usually it is mild and referred to the right supraclavicular fossa. This pain has never been noted in the absence of the pleuritic pain although it is not necessarily present with the pleuritic pain.

Tetraethylammonium chloride was used at this hospital for the relief of pleuritic pain secondary to pulmonary infarction and it was believed that a trial with this drug was warranted when pleuritic pain occurred after obtaining a specimen for liver biopsy is obtained.

We have used tetraethylammonium chloride for the relief of pain in 28 patients who had sufficient pain to require some form of analgesia (table 1). One of these was given the drug prophylactically. In 23 patients there was at least 50 percent relief from pain with the intravenous administration of from 75 to 200 mg. of the drug. Seven experienced temporary relief and required a second injection to gain permanent relief. One patient obtained less than 50 percent relief from pain, but with a second administration attained 90 percent relief

TABLE 1--Results with tetraethylammonium for relief of postbiopsy pain

Patient	Age	First dose	Percent of relief	Duration of relief	Second dose	Percent of relief	Duration of relief	Comment
1	25	Mg 200	80	15 minute	Mg 200	90	Permanent	Dramatic relief
2	22	200	90	Permanent	-	-	-	Relief within 2 minutes of injection
3	30	200	100	21 hours	200	100	Permanent	Relief within 1 minute of injection.
4	27	200	85	Permanent	-	-	-	Severe pain with apprehension
5	21	200	90	do	-	-	-	Dramatic relief
6	55	200	40	20 minutes	NR	-	-	
7	23	200	40	do	200	90	Permanent	
8	43	200	85	Permanent	-	-	-	
9	29	200	0	-	NR	-	-	
10	36	200	40	Permanent	-	-	-	
11	58	75	60	-	NR	-	-	Within 30 minutes obtained 100 percent permanent relief
12	41	200	95	Permanent	-	-	-	
13	22	200	100	30 minutes	200	70	Permanent	
14	49	200	75	Permanent	-	-	-	
15	21	200	75	5 minutes	NR	-	-	Second dose not required because cycle of pain and breathholding was interrupted
16	29	200	100	Permanent	-	-	-	
17	21	200	50	do	-	-	-	
18	21	200	75	do	-	-	-	
19	49	200	95	do	-	-	-	
20	31	200	75	do	-	-	-	
21	36	200	50	1 hour	200	40	2 hours <sup>1</sup>	Third dose of 200 mg gave 30 percent permanent relief
22	26	200	50	3 hours	200	20	Permanent	
23	27	200	75	Permanent	-	-	-	
24	27	200	90	5 minutes	NR	-	-	Second dose not required because cycle of pain and breathholding was interrupted
25	31	200	90	Permanent	-	-	-	
26	21	125	60	do	-	-	-	
27	41	200	75	do	-	-	-	
28	32	200	90	5 hours	200	70	Permanent	

<sup>1</sup> Given prophylactically 10 minutes prior to biopsy.

<sup>2</sup> Estimated percent less pain than on previous biopsy.

<sup>3</sup> NR—Not repeated.

which was permanent. The patient to whom the drug was given prophylactically had considerable pleuritic right shoulder and abdominal pain following a previous removal of a specimen for liver biopsy. He was given no preoperative medication except 200 mg. of tetraethylammonium chloride intravenously 10 minutes prior to the procedure. This preparation consisted only of infiltration of the skin at the needle insertion site with 1 percent procaine. No procaine was used in the subcutaneous tissues, the pleura, or the liver capsule. The only complaint was a dull midabdominal pain during the procedure and later only mild abdominal pains lasting about 2 hours. Since it is common to note such moderate pain without the use of a special medication the exact role of the drug in preventing pain in this patient is inconclusive. Only one patient of this series obtained no relief.

The effectiveness of this drug is not limited to the extent of relief experienced by the patient nor to the permanence of the relief. With the onset of the sharp, shooting pain of induced pleuritis, the patient immobilizes his chest and holds his breath in an attempt to alleviate his discomfort. At some point, however, he must inspire and with this he again feels pain. The relief from this type of pain with tetraethylammonium chloride is rapid and dramatic. It often occurs within 1 minute of the time of injection. The patient is then able to inspire with minimal or no pain. Thus the cycle of pain followed by breathholding is stopped and the patient can regulate his breathing with no discomfort.

#### DISCUSSION

The use of tetraethylammonium chloride to relieve pain was described by Caller et al. (5). Visceral and anginal pain have also been alleviated with this drug (5). Other than the experience recorded by Israel et al. (3), we are not aware of any reports of the relief of pleuritic pain with tetraethylammonium chloride. In our series the pain alleviated has been mainly in the pleura and right shoulder. Little effect has been noted on the dull abdominal discomfort produced by the procedure. This drug was immediately effective in relieving the nausea in four patients. This is probably related to the reduction of gastric motility by tetraethylammonium chloride (6). In our series we have noted no adverse effects from this drug. The dose used has been well below the levels at which toxic manifestations are recorded (7). This, plus the fact that most patients in this series were not over 40 years of age, may account for the absence of complications. The toxic manifestations and contra-indications of this drug have been described by Birchall et al. (8) and should not be disregarded particularly if there is any evidence of excessive bleeding. It is not intended that the drug should be used routinely, but rather

that it should be reserved for the patient with distressing symptoms following removal of a specimen for liver biopsy.

### SUMMARY

The intravenous administration of 200 mg. of tetraethylammonium chloride gave relief of pain following removal of a specimen for liver biopsy in 26 of 27 patients. Suggestive evidence is given for the prevention of pain with the use of the drug prophylactically in 1 patient. Tetraethylammonium chloride would seem to be a desirable drug to use for this purpose because of the dramatic relief from pain and nausea and because of its lack of side effects.

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# Recurrent Ectopic Pregnancy

## Report of a Case

JOHN LINGENFELDER, Lieutenant (MC) U. S. N.<sup>1</sup>

RECURRENT ectopic pregnancies are unusual and occur in about 4 or 5 percent (1) (2) of cases in women who are able to conceive following operation for that condition. Recurrent ectopic pregnancy in the site of a previous salpingo-oophorectomy for tubal pregnancy is, however, exceedingly rare. A survey of the available literature discloses 37 previous cases of this unusual and interesting condition. In 1926 Hasselblatt (3) made an exhaustive survey and was able to report 19 previous cases and added 2 cases. In 1935 Deutsch and Clair (4) found 8 other case reports in the literature and reported a new case of their own. Since that time Burtlett (5), Casler (6), Forman (7), Ballentyne et al. (8), Gee (9), and Frunkel (10) have all reported additional cases.

### CASE REPORT

M. R. N., a 30-year-old white gravida III, para I, was admitted on 13 June 1947. Her chief complaints were cramps in the left lower quadrant of the abdomen for 3 days and weakness and fainting during the preceding 12 hours. The initial onset of symptoms had followed coitus. Her previous history included a left salpingo-oophorectomy in 1939 for ruptured left ectopic pregnancy. At this time the surgeon also performed a right salpingostomy and uterine suspension. In 1942 another uterine suspension was performed and the following year in 1943 the patient had a spontaneous 3 month abortion. In October 1946 the patient had a full term normal delivery of a viable male infant.

She stated that her last menstrual period occurred on 6 May 1947 and was normal in character and flow. After the onset of her first symptoms she consulted a physician who shortly before entry into the hospital performed a pelvic examination which brought on an acute exacerbation of pain and faintness. She was then transferred to the hospital with a presumptive diagnosis of ruptured ectopic pregnancy. Upon admission, she was in obvious distress and in early shock. Blood pressure was 16/66 and the pulse rate was 112. Examination at that time revealed tenderness and muscle guarding in both lower quadrants, more severe on the left. On pelvic examination an indefinite but extremely tender mass in the left adnexal region was felt. The cervix was soft and slightly cyanotic. A cul-de-sac aspiration revealed bright red blood. Plasma infusion was begun prior to the cross-matching for transfusion. A diagnosis of ruptured ectopic pregnancy was believed certain.

<sup>1</sup> Lt. C. Naval Hospital Guam, M. I.

**Operation.**—Gross blood and clots were noted on opening the peritoneum. The left uterine cornu was seen bleeding briskly from what appeared to be a ruptured pea-sized bleb at the apparent site of the previously excised tube. This entire area was removed with a circumferential excision and the defect of the uterus was closed with interrupted chromic catgut sutures. Inspection of the right tube and ovary showed normal-appearing organs. The abdomen was closed in layers. Transfusion of 500 cc of citrated whole blood was started just prior to completion of surgery, at which time the patient had received 700 cc of plasma. The patient's condition was much improved following surgery. Her postoperative course was uneventful.

#### *Pathologist's report*

**Gross examination.**—Specimen consists of a wedge-shaped piece of tissue measuring  $0.75 \times 1.5 \times 1.5$  cm. On one aspect there is a bleblike cyst measuring 0.5 cm in diameter and which is apparently ruptured. The cyst has a hemorrhagic appearance.

**Microscopic examination.**—The section reveals smooth uterine muscle invaded in areas by hyperchromatic syncytial cells. There is also an area of hemorrhage with chorionic villi within it. These villi have two layers of cells. Within the myometrial portion of the section there is a cavity lined by cuboidal epithelium resembling the epithelial lining of the interstitial part of the uterus.

**Diagnosis.**—Ectopic pregnancy in stump of previously excised left fallopian tube.

#### DISCUSSION

There are several interesting aspects to this case aside from the rarity of the condition itself. First, interstitial ectopic pregnancies usually progress to a much later stage of development before rupture occurs and in this case, as in Richardson's (*11*) case, one must postulate that implantation occurred in the most superficial part of the remaining portion of the tube for rupture to occur so early. Another interesting point is that the patient had had two subsequent pregnancies after the first salpingo-oophorectomy for tubal pregnancy, and this would indicate that the remaining right tube was patent. The patient did not give the usual history of preceding sterility for several years; her last pregnancy had terminated only 8 months before with a full-term normal delivery.

Since only the right ovary remained at the time of this accident, it is evident that a transmigration of the ovum occurred with implantation in the opposite tube. As to the mode of transmigration there are three possibilities:

(a) Internal migration of an ovum which had been fertilized in the right tube, across the fundus and then up into the partially or completely canalized cornu on the left side.

(b) External migration of the ovum and implantation in a pocket of the tube on the left side, which had regenerated or recanalized and through which sperm had migrated to fertilize the ovum prior to implantation.

(c) External migration of an ovum which was fertilized by spermatozoa which had ascended through patent right tube with nidation occurring in a pocket of the tube at the site of the previous operation

The first explanation in this case would seem to be the easiest mechanically, and there is some evidence (Forman (7)) to indicate internal migration can occur. Most writers (4) (11) (12) believe external migration to be the usual method of implantation, and this cannot be ruled out in this case.

The treatment in this case was cornual excision which would theoretically offer the most assurance against recurrence. A wedge excision in all salpingectomies would seem to be indicated if not offering too many technical difficulties at operation. While cornual excision is probably the surest method of preventing recurrence, there are instances in which this has failed (Nache (13) quoted by Ballentyne et al. (8)). Labry (14) in discussing LeClerc's (15) paper stated that he believes that occasionally in tubal abortion the tube may be tamponaded after expression of the pregnancy and the tube then left in situ. In the same paper Cotte (16) expresses the opinion that the corresponding ovary should be removed with the pregnant tube in order to insure that ova dropped from that side would not be wasted by being unpassed. The latter would appear to be an extreme viewpoint in that it is known that external transmigration can occur, further ovarian tissue should be conserved. The view of conserving the tube in tubal abortion would seem to entail immediate as well as future hazard from recurrence and from a practical viewpoint can seldom even be considered.

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# Thrombocytopenic Purpura

## Discussion and Report of a Case

FENIMORE T. JOHNSON, Lieutenant (MC) U. S. N.<sup>1</sup>

THE tendency to bleed into the skin and from the mucous membranes is known as "purpura." As a term it has "no more pathological significance than has the term, anemia" (1).

Any classification of hemorrhagic diseases is unsatisfactory because of our incomplete knowledge of the fundamental processes involved, but, in general, three main types may be distinguished: (a) those associated with a disturbance in one or more of the chemical factors involved in clotting; (b) those resulting from deficiency or defect of the blood platelets; and (c) those secondary to an alteration in the capillary walls.

### ETIOLOGY

Many theories have been advanced concerning the cause of thrombocytopenia (3). Kaznelson believed that the platelets were destroyed in the spleen in excessive numbers, and more rapidly than normal. Frank postulated that a substance is formed in the spleen which inhibits platelet formation from the megakaryocytes. It is possible that the primary disorder is a defect in the capillaries, permitting blood to escape through their walls. According to this view, the platelets are used up in attempt to close up the multiple vascular defects.

The importance of a capillary defect as a factor in the etiology of purpura is indicated by clinical experience. As pointed out by Wintrrobe (3), hemorrhage is not always closely correlated with the degree of thrombocytopenia and purpura does develop when capillaries are deliberately damaged, as in the tourniquet test.

Thrombocytopenic purpura may be either primary or secondary. The latter is by far the more common (3). It may be caused by infections, either current or recent, by drug intoxications, or by a disease causing depression of the bone marrow (3).

<sup>1</sup> U. S. Naval Hospital, Philadelphia, Pa.

Primary thrombocytopenic purpura rarely occurs in more than one member of a family, although a family history of bleeding tendency is not unusual (4). Women are affected more often than men, young children more often than older children, and Negroes uncommonly (4). A predisposition to allergic manifestations, especially asthma, has been noted in some patients (5).

### DIAGNOSTS

The usual duration of this disease is from 3 to 18 months (6). A slightly enlarged spleen is palpated in about one-third of the cases; general lymph node enlargement is not found (3). This is the most common form of the disease. There are two other forms (7): the first, and most serious, although fortunately the rarest, is the fulminating form: the first attack may prove fatal, and hemorrhage may be widespread. In addition to the visible bleeding, the patient may have hidden hemorrhage and the central nervous system may be involved. Abdominal pain may accompany gastrointestinal bleeding. The other, a chronic, recurrent form, is characterized by periodic episodes of hemorrhage of varying severity, with intervals of apparently perfect health during which the bleeding tendency lessens although the platelet count remains about the same low level.

Thrombocytopenia may occur with or without noticeable symptoms of free bleeding, or even of prolongation of the bleeding time. Spontaneous bleeding usually does not occur unless the platelet count is below 60,000 cu. mm. (3).

Primary thrombocytopenic purpura is diagnosed as such only by exclusion of all the known underlying causes for platelet deficiency. With increasing skill and further investigation, the diagnosis of primary thrombocytopenic purpura becomes less common.

The hemostatic properties of the platelets are well known. By their agglutinative properties they can form a plug which serves directly to seal an injured blood vessel until a permanent clot is produced. Upon their subsequent dissolution a substance is released which may initiate the coagulation process. Only a small number of platelets are required for this. The excess not used brings about retraction of the clot, known as syneresis, by some mechanism not known at present. Syneresis is important in hemostasis because it causes the blood vessel walls to come together. When there is no platelet excess, blood clotted in a test tube fails to retract.

Capillary resistance may be measured by the tourniquet test. By compressing the arm or leg with a sphygmomanometer cuff midway between the systolic and diastolic levels for 5 minutes, petechiae may be made to appear below the point of compression in numbers proportional to the fragility of the capillaries. A more informative test

is the suction test, in which suction is applied on the forearm and the negative pressure recorded at which petechiae appear. Normally this ranges between -200 and -300 mm. of mercury (2).

In children, great difficulty is encountered in differentiating this condition from leukopenic leukemia, for thrombocytopenic purpura is almost invariably present, and is often the first indication of leukemia (6). Bone marrow biopsies are helpful in eliminating this diagnosis.

#### TREATMENT

The natural tendency in acute phases or exacerbations of idiopathic thrombocytopenic purpura is toward improvement (3). Treatment, therefore, should consist of bed rest, general nursing care, appropriate diet, and antianemic treatment. There is no evidence that any of the vitamins are of specific value (7). If there has been much bleeding and shock is imminent, blood transfusions are necessary. Small transfusions at intervals of 2 to 7 days have been said to stimulate blood formation and to supply platelets (3).

The popular conception that splenectomy is an infallible remedy can be challenged because the varied course of the disease makes adequate appraisal of the effects of surgery practically impossible. There are, however, indications for surgery, such as severe bleeding which fails to subside after repeated transfusion, frequent recurrences which jeopardize growth or development or the social or economic status of the patient, the occurrence of the disease in women past puberty because of the possibility of serious bleeding at menstruation or during pregnancy (4).

#### CASE REPORT

A 2-year-old white boy was admitted because of petechiae and ecchymoses widely scattered over the cutaneous surface of his body and, to a lesser extent in the mucous membranes. When these appeared, suddenly, 4 days prior to admission, he was otherwise perfectly well except for a mild upper respiratory infection. He had no lymphadenopathy, but the spleen was palpable 3 cm. below the left costal margin. The day following admission he had several moderately severe nosebleeds.

On admission his bleeding time was 9½ minutes, and no clot retraction occurred after 24 hours. This suggested a thrombocytopenia; confirmed by a platelet count of 45,000 per cu. mm. The clotting time was normal (7 minutes). The Tourniquet test was positive. There was no history of allergy. However, while in the hospital he had a contact dermatitis from mepholonate over the site where a specimen of bone marrow was taken for biopsy. His father has seasonal hay fever. His mother has hives when exposed to temperature variations. One brother had an intestinal allergy to milk, both human and bovine, and was raised on a soybean milk substitute the first 2 years of life. One sister has had one attack of asthma.

On the day preceding the onset of his symptoms, this patient had received nose drops containing tyrothricin. He had had no other medications for several months.

Following the epistaxis on the second hospital day, a transfusion of 140 cc. of citrated whole blood was administered. By the next day the bleeding time had dropped to 4½ minutes, and the platelet count rose to 144,000. A second transfusion of 240 cc. was then given, and the bleeding time dropped to 2 minutes. Seventeen days after onset the purpura completely disappeared, and the spleen was barely palpable.

This patient has been observed for 19 months, and has shown no signs of recurrence.

#### SUMMARY

Thrombocytopenic purpura occurs because of some factor which brings about a reduction of the number of blood platelets. It appears in an acute or chronic form and is characterized by bleeding into the skin, subcutaneous tissues, and internal organs. Spontaneous recovery is the rule and drugs are of no value.

A résumé of the initiating factors, signs, and symptoms, and the treatment of thrombocytopenic purpura is presented.

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# Treatment of Bronchial Asthma With Psychotherapy

## Report of a Case

ARNOLD B. SCHEIBEL, *Captain, MC, A. U. S.*<sup>1</sup>

THE relationship between bronchial asthma and allergy has been familiar since the discovery of allergens. It has been found that the person with asthma often is not only sensitive to a specific substance, removal of which exerts a therapeutic effect on the illness, but also that he often presents a history of other allergic manifestations such as eczema, urticaria, or hay fever—a true allergic diathesis. The importance of emotional factors in the causation of asthma has gained acceptance more recently and has followed the work of a small number of investigators, among them Salter, Rogerson, Obendorf, Freneli, Alexander, et al. It had been found that, not unlike the allergic diathesis in asthma, there also seems to be a rather typical emotional diathesis—a constellation of environmental and psychologic characteristics that are seen with great frequency in the asthmatic.

The patient is usually described as a passive-aggressive-dependent type of person whose love and dependency needs are so great as almost to defy fulfillment. A sense of insecurity and tremendous amounts of unconscious hostility and latent aggressive trends result from these relatively unfulfilled dependent needs. The principal parent figure, usually the mother, is found to be an aggressive domineering person whose erratic, smothering type of protective love cloaks her own feelings of hostility and her frustrated achievement drives. The result is usually a timid, querulous person with few inner strengths, and severely impaired ability to function as an independent organism. Weiss has compared the asthmatic wheeze to the cry of the infant for his mother.

The following case is presented as an illustration of a situation in which both allergic and emotional factors were operative in the causa-

<sup>1</sup> Brooke General Hospital, Fort Sam Houston, Tex.

tion of the patient's asthma. It is of additional interest insofar as it presents a longitudinal picture of diagnostic and treatment procedures at the Child Guidance Clinic of the Neuropsychiatric Service at this hospital.

#### CASE REPORT

This 10-year-old boy was first brought to the clinic because of severe bronchial asthma in September 1945. The mother complained also of the boy's irritable, elusive and occasionally bizarre behavior. He spent most of his time sitting in his rocking chair listening to the radio; he spoke infrequently and used sign language a good deal and showed much negativistic behavior toward his parents. His attendance at school was erratic because of his numerous asthmatic attacks in the past 9 years. At the time of his coming to the clinic the mother estimated that the patient was spending from one-half to two-thirds of his time in the children's ward of the hospital. Although his asthmatic attacks while in the hospital were neither as severe nor as frequent as when he was at home, vigorous medication was still necessary when he had his attacks. In the first year and a half of his life the patient had eczema and articular although there was no history of allergic phenomena in the family. Thorough examination had revealed no significant pathologic findings, and the child had been referred to the Child Guidance Clinic for further study.

He was a wanted child and was born about 20 months after his parents' marriage. When he was 4 years old his father left for active duty in the Air Force and did not return home until the patient was 6. During that time the patient and his mother were inseparable and the return of the father into the home precipitated repeated emotional storms in one of which the patient cried to his mother "Let's lock the door and not let him in." Relationship between the boy and his father improved somewhat in the past 3 years but there were no open demonstrations of affection. The birth of a later sister when the patient was 7 produced no obvious disturbance. The mother always felt that the boy was slightly abnormal, and "slow" and had taken him to a great number of physicians. She was incensed by his continuing possibly hostile attitude and his inability to make a better showing in school. His asthmatic attacks frequently came on in the evening shortly before the mother's own bedtime. When this happened the mother was obliged to spend the night in her son's room. An interview with the father was considered desirable but he could not leave his job during working hours.

#### Examination

The patient is a small asthmatic, rather elfin-looking boy, appearing somewhat younger than his stated age. He insisted on remaining with his mother while she was interviewed by the psychiatrist. He said he would not listen, but it was noted that the comic book that he was supposedly reading was held upside down. Questions were answered with single words or by sign language, and for the remainder of the time he sat dreamily in his chair gazing at the opposite wall of the office. His behavior continually angered his mother who alternately threatened and spurred him on.

Psychologic examinations revealed that the boy was functionally of borderline mentality with a mental age not exceeding the average 7-year-old. His I.Q. (Stanford-Binet) was 50. There were strong suspicions, however, that this was not a true indication of his basic potentialities as emotional blocking might have

played a role in this performance. Part of this opinion was based on the fact that his reading ability was equal to that of the average child starting fourth grade. His comprehension and recall were also adequate and equal to that of the average child 9 or 10 years of age. He appeared to have a well-developed fantasy life and showed many symptoms of personal maladjustment.

### Treatment

Both the patient and his mother were given weekly therapeutic interviews; the boy was seen by the psychiatrist in play therapy and the mother by the psychiatric social worker. Because of several severe bouts of asthma, therapy was not started until 3 months after the initial contact with the clinic.

When the patient entered the playroom for the first session he was indecisive and announced that the toys were of no interest to him. After some encouragement he finally decided to play checkers. The first time the patient made a "king" and it was pointed out that he was now a "king on the board," he said, "No, I'm not; I'm nobody." He lost all the games and said, "I don't mind losing. It's just the sportsmanship." It was suggested that it was all right to feel bad about losing or about being unimportant, but the patient could not accept this. His feelings about his smallness were again brought out as he had the therapist build large block structures, followed by the construction of much smaller buildings of his own. The differences in size were further elaborated verbally. In the second session the patient experimented with small shows of hostility, throwing crumpled paper on the floor, messng defiantly with the finger paints, and then more enthusiastically when he discovered that rejection was not threatened. As he gained confidence he spattered paint and tore off sheets of paper with distinct enthusiasm and a volatile flow of speech. He came to the third session with his own set of finger paints and produced a picture of a heart inside a larger heart, writing the word "love" under it. He asked for the therapist's first name and then wrote "Arne's" above the heart. This meant "Arne's love" which the therapist obviously owed to his wife. In the patient's home, however, there was no love since his mother and father always fought. He disregarded the suggestion that love seemed rather important to him and produced another version of "Arne's love." He then admitted that he was not loved, said that love was what he wanted, and volunteered to produce something for every room in the Child Guidance Clinic. He said there were five members in his family including a talking parrot, but specifically excluded the younger sister, stating that he was the only child. During the session he appeared to be testing out the therapist, making a bid for his love and attention, and indicating how lonely and unloved he was.

Next time the patient brought the therapist an orange. He then spent most of the time drawing animals for the therapist and adding abdominal appendages which he first called "the tail," then later "the tip" and finally "the tits." There was some discussion of masculine-feminine differences, but the patient blocked rather readily. In the next period he further amplified his feelings about his family by drawing a heart with an arrow through it, printing "happy" beneath it. He said this represented the whole world and also his family, both of which he wished to be happy. He then drove a toy rubber knife through the heart until he had torn it up completely, stating that this was what happened when there was a fight in the family. There followed a discussion of how the children of a family felt when the parents fought, and the patient was finally able to admit that aggressive attitudes on the part of the parents severely threatened the security of the children. The patient then carved the initials "U.S.V." on

the back of one of the playroom chairs, and when it was suggested that it would be wise to stop since this would eventually come to the attention of the general, he launched into an attack against "the old general who is always putting his nose into things," which increased in feeling until the patient was running around the room, shaking his fist and swearing. It was suggested that generals might be like fathers and the patient agreed, admitting that they were even more like mothers, "always minding somebody else's business." After verballing and acting out tremendous amounts of hostility the patient printed a sign reading, "mind your own business" hung it outside the door, then in a triumphant frame of mind made his mother come back to see it.

In the following session the patient became physically aggressive toward the therapist and when it was pointed out that this could not go on, the patient hit himself over the head with his toy revolver. It was suggested to him that he probably often hurt himself when he felt like hurting others. He said this was true, and then described how he wished he were a magician so that when his parents came to whip him, he could turn the tables and give them a merciless drubbing. Unfortunately he was small and unimportant and his wishes never mattered. The therapist agreed that he could not do this, but suggested that it was sometimes as good to talk out one's feelings and the patient agreed.

In the next several interviews, the patient continued to act out aggressive feelings toward the therapist, gradually developing a more realistic conception of the limits to which he could carry this. He could now express his feelings of hostility and frustration over losing checker games and was able to state further that he realized he lost because of his own inexperience compared to the therapist's and that eventually he would get better and might win. He was complimented both on the improvement in his playing technique and on his more realistic and mature attitudes. By the end of the thirteenth session it was felt that the patient deserved a temporary cessation of therapy since improvement had been so great. At that time he had not had an attack of asthma for about 7 weeks.

The mother reported distinct changes in the boy's personality, with enthusiastic socialization, a normal amount of small-boy aggressiveness and an increasingly happy relationship between father and son. She was also pleased that his work in school had shown improvement. Her own attitude, too, had shown definite changes. She had become relaxed and relatively free of anxiety concerning the patient. She felt that he was capable of proceeding at his own rate and let him do so. The result was obvious improvement in the mother-son relationship. A general change for the better in the family atmosphere but occurred along with symptomatic improvement in the boy.

In an attempt to determine whether there was any noticeable change in the level of mental function and potential over that indicated by the first set of psychometric evaluations, a second group of tests was given to the boy 1 month following cessation of therapy. The Stanford-Binet findings were astonishingly consistent in their demonstration of a functional age level 3 years below the stated age. Arithmetical conceptions, practical judgment, visual motor coordination, and language comprehension all continued to show retarded developmental status. On the other hand, the Rorschach data delineated basic intellectual qualities that were well above average and near the adult level. There was good productivity, ability to maintain attention, abstract conceptualization and adequate intellectual control. The performance intelligence examination (Goodenough) reflected growth in use of abilities during the therapy period. Since school work was also up to average or better in the later stages and following therapy, and his reading also adequate for his grade, these, along with the

Goodenough scale and the Rorschach, seemed to refute the Binet findings of continued borderline intelligence. The psychologist made the suggestion that the possibility of organic dysfunction, especially convulsive disorder, should be explored. An electroencephalogram was normal and there was no evidence of any organic lesion. The final impression was that the boy was still emotional and immature for his age and approximately at the intellectual level as indicated by the Binet rather than the Rorschach test.

In the 9 months since the termination of therapy, the patient has been seen periodically. He has been completely asthma-free except for one brief episode early in the pollen season.

#### DISCUSSION

This patient presented a problem of severe bronchial asthma associated with a moderately severe personality disorder. His asthma appeared directly related to a combination of definite allergic diathesis, plus a disturbed emotional situation in the family environment, manifested primarily by poor parent-child relationships. Over a relatively short period of therapy in which the boy was seen once each week for 13 weeks by the psychiatrist, and the mother for half-hour periods at similar intervals by the psychiatric social worker, definite improvement occurred in family interpersonal relationships as well as in the boy's personality. The complete clinical remission of the patient's asthma, with the exception of one brief episode early in the pollen season, would seem to indicate that psychogenic factors were operating as an important trigger mechanism in setting off this patient's attacks of bronchial asthma.

Sulzberger, Baer, and Levine (11) used pyribenzamine ointment locally for various skin disorders but not for *Rhus* dermatitis and reported that it produced an eczematous allergic reaction in 2 of 90 patients. Strauss (12) confirmed this observation and showed that pyribenzamine, not the vehicle for the drug, produced an acute, oozing, edematous dermatitis.

Using a large number of hospitalized patients of the same age group, the results obtained by the simultaneous local use, in the same persons, of 2 percent pyribenzamine ointment and calamine lotion containing 1 percent menthol and 1 percent phenol were compared. In addition, the effect of orally administered pyribenzamine was observed in 5 patients. These results are shown in table 1. As far as possible, areas of about equal involvement were chosen on each upper or lower extremity, treated differently, and compared daily. In addition all areas were treated with warm compresses or warm baths. All patients were examined daily and were invited to comment at the termination of treatment.

TABLE 1—Comparison of effects of pyribenzamine ointment and calamine lotion with phenol and menthol.

	Grade of severity of dermatitis <sup>1</sup>					Total
	I	II	III	IV	V	
Patients						
Fraxinus severe	9	19	30	11	1	61
Pyribenzamine more effus.	9	13	26	10	1	61
	6	8	12	4	1	31
	4	5	8	0	0	21
	5	4	6	0	0	16
	2	5	13	0	1	23
	6	4	3	0	0	13
	7	9	14	5	0	35
	2	3	12	0	1	16
	3	3	5	0	0	11

<sup>1</sup> Grade I least and Grade V most severe.

In three patients calamine caused excessive drying and cracking of skin, especially around joints. On the other hand, three patients treated with pyribenzamine ointment had urticaria (two generally and one locally). The symptoms of urticaria were quickly and completely controlled by the use of an antihistaminic, tagatene, given in doses of 50 mg. four times daily. In four patients, pyribenzamine ointment, although helpful up to a point, seemed to produce redness and burning sensations and to retard complete recovery. When its use in these patients was discontinued and succeeded by nupercainal, relief from the burning sensation and complete recovery promptly occurred. In joint regions pyribenzamine ointment kept the skin soft. The masking effect of calamine lotion had a psychic appeal for some patients. A few patients commented favorably on the retarding of serous oozing by the calamine lotion, but most thought that greater

oozing with the pyribenzamine ointment produced more rapid decrease in swelling.

Fifty milligrams of pyribenzamine was given orally five times a day to four Grade II patients, but was promptly discontinued because it did not relieve itching. Two patients had a complicating purulent infection that responded dramatically to use of aureomycin orally. In general, removal of the tops of the larger blebs and the application of warm compresses appeared to lessen pain and accelerate healing. Unopened small blebs and vesicles dried readily.

#### COMMENT

Appraisal of the effects of various forms of treatment for *Rhus* dermatitis is difficult because of uncontrollable variables. Using different forms of local therapy in areas of a similar degree of involvement, in the same patient, allows the observer to evaluate the relative merits of the treatments employed. Unless investigations are conducted in this manner, conclusions are likely to be invalid. Contradictory statements concerning the efficacy of intramuscular injections of poison ivy extract in the treatment of *Rhus* dermatitis result from the fact that lesions on the same patient cannot serve as a basis of comparison. Unfortunately, most workers have used few if any controls. It is recommended that a large group of hospitalized patients be used for an appraisal of the effect of injections. Equal numbers of cases of about equal severity should be chosen for the treated and the control groups. The patients receiving injections should receive no local treatment. The opening of the larger blebs and bullae and the application of warm Burrow's solution compresses is an effective method of treating *Rhus* dermatitis. Although it is uncertain whether the additional use of medicaments applied to the surface essentially shortens the course of the illness, this investigation gave some indication that the use of pyribenzamine ointment, locally, may accelerate healing.

#### SUMMARY

*Rhus* dermatitis constitutes an important cause of loss of time from duty. In 70 patients, results of the simultaneous use of pyribenzamine ointment and calamine with phenol and menthol were compared. These treatments were about equally effective in the control of pruritus. No constant effect on the speed of healing was observed since one-half of the patients improved equally rapidly with both medications. Of the remaining half, 71 per cent improved more rapidly with pyribenzamine. Further trials with pyribenzamine ointment locally are recommended, especially on lesions around joints.



Figure 1.



Figure 2.

Roach type clasps were chosen to retain the case because of the short crowns, but since the contours of the teeth were unfavorable for good retention even by this type of clasp, mild grooves were cut just below the height of the contour on the upper and lower first and second bicuspids and first molars with diamond stones, and smoothed with cuttlefish disks, then pumice, and finally burnished with rubber wheels. These grooves were then treated with 4 applications of sodium fluoride. The grooves were not cut through the enamel, but merely provided



Figure 3.



Figure 4.

definite areas in which to place the Roach T. The bite opening was determined by experimentation to be about 2 mm. This was the least amount that would provide sufficient space for a restoration, and apparently the maximum amount that would still allow for a comfortable freeway space. A trial setup with facings showed that even with the alveolectomy and the new lingual position of the labial portion, it would require 8 teeth to provide a cosmetic result. A lower partial denture with cast occlusal shims would be used to provide the bite opening. The cases were waxed accordingly and cast in vitallium.

The cosmetic result on placement of the dentures is apparent in figures 3 and 4. Closing of the bite caused constant temporomandibular pain varying in intensity in direct ratio to the amount of work performed by the jaw. Within 1 week after insertion of the cases, lessening of this pain was reported, and at the end of 1 month no discomfort was present. At the end of 12 months, there was no recurrence of joint pain. Ability to bite and masticate food with ease without associated palatine pain was reported within 1 week. Psychologically, an appreciable benefit was noticed in about 3 weeks, which was the period necessary for the patient to realize that her mouth need not be covered in conversation, smiling, or laughing. When the moment was reached, the automatic covering gesture with the handkerchief or hand began to cease, and by the end of 8 weeks, had been completely abandoned.



# Effectiveness of Newer Drugs in Seasickness

WALTER L. WRIGHT, Lieutenant, junior grade (MC) U. S. N.<sup>1</sup>

MOTION sickness has been observed for centuries, but no intensive study had been carried out until World War II when, because of the large-scale amphibious operations and the great number of men needed for sea duty, it was realized that efforts must be made to keep motion sickness at a minimum and thus maintain men at their maximum efficiency.

The data in this article were obtained during a tour of duty on a naval transport, the U. S. S. *General George M. Randall*, which carries dependents, civil service personnel, and troops to installations in the Pacific area. Thus results were compiled from the action of antihistaminic drugs in men, women, and children, giving a more complete picture than would be possible if only young men were used in the study.

Cecil (7) defines motion sickness as "a condition due to frequently repeated oscillating movements of the body in a ship or airplane, characterized by dizziness, nausea, vomiting, pallor, and sweating." The syndrome is essentially due to disturbed vestibular function. Visual, psychogenic, and kinesthetic factors play subsidiary roles that vary with the individual. It was found that aboard ship food odors and poor ventilation were predisposing factors.

Symptoms of motion sickness appear suddenly and any or all of the following are present: nausea, excessive salivation, mental depression, vomiting, headache, pallor, and cold sweats. In about 45 percent of persons making their first ocean voyage the self-descriptive condition "epigastric awareness," is present although they do not become ill.

The psychogenic factor has been noted to be an etiologic agent in motion sickness. Desnoes (5) pointed out that in some susceptible persons, signs of seasickness develop as they board the ship and prior

<sup>1</sup>U. S. S. *General George M. Randall*

to sailing. The author has seen three women, who had been sick on a previous voyage, who became nauseated and vomited while walking up the gangplank to the ship.

According to reports in the literature, infants under 3 years of age and elderly persons are seldom afflicted with motion sickness. It is difficult to determine if the frequent gastrointestinal upsets seen in small infants are due to motion sickness or to the change in milk and water.

Motion sickness in the past has been treated by sedation and/or the use of drugs that suppress the parasympathetic nervous system. Some of the drugs used were sodium amytal, scopolamine hydrobromide, barbital, sodium nitrate, bromides, belladonna, and various coal tar derivatives. Hamilton (6), in 1932, reported 400 cases of seasickness in persons between the ages of 16 and 60 years and concluded the most satisfactory drugs in treatment were sodium amytal, scopolamine hydrobromide, and barbital. Bryan reported a series of cases treated by hypnosis with unsatisfactory results.

During World War II, intensive and thorough investigation in the study of motion sickness was carried out. As a result of this work, Army Motion Sickness Preventive, or M. S. P., was conceived. This consisted of the following drugs in a capsule: sodium amytal, 130 mg.; atropine sulfate, 0.3 mg.; and hyoscine hydrobromide, 0.4 mg. This medication was distributed to service personnel (during the war) and was taken one-half hour before embarking and then not oftener than every 4 hours for as short a period as possible. Several investigators reported on the efficacy of M. S. P. as a preventive and there was a wide range of results. The best results reported showed that only 1 percent of personnel became seasick while taking M. S. P. whereas 10.1 percent of those who received placebos and 28.4 percent of the untreated personnel became ill.

Assuming that M. S. P. was the best known method of therapy at that time (1944), it was the only standard that could be used for comparison with newer drugs. I chose benadryl for intensive trial in the treatment of motion sickness because it was suggested to me by another physician who stated that he had no real basis for believing it to be of value but would like to see it tried. About 6 weeks after this investigation was started, Gay and Carliner (7) released their work on dramamine. As dramamine is also an antihistaminic and has a benadryl base I was encouraged to continue with the study of benadryl and also secured enough dramamine to include it in the investigation.

The results of the use of these drugs in seasickness only are discussed in this article; I had no opportunity to study their action in airsickness.

### PROCEDURE

The medications used in this study were Army Motion Sickness Preventive, benadryl, dramamine, and placebos.

Because different weather conditions were encountered on each trip, all drugs were used in a selected number of cases on each voyage and the results tabulated on a comparable basis. This article is based on the over-all average results during each trip; thus the results obtained from the use of any one drug were not bettered by good weather conditions.

The investigation was divided into two phases therapeutic and prophylactic.

In the determination of the therapeutic value of the drugs, no presailing medication was given to any passenger. Therapy was begun only when the person reported to sick bay with symptoms of motion sickness. The first four persons seen were given placebo, M S P., benadryl, and dramamine respectively in that order, and the routine repeated with each succeeding four persons. Each person was instructed to take one tablet immediately and one every 4 hours thereafter until symptoms were relieved or until five tablets were taken. Those persons given benadryl were told to take two capsules immediately and then one capsule every 4 hours. All were told to return when both objective and subjective symptoms subsided, and the patient's word was used as the index of the effectiveness of the medications. Two days was set as the time limit in which drugs were credited as being of value because in that time 40 percent of those persons under study were symptom-free and required no medication. One thousand two hundred cases of motion sickness were observed in this phase of the investigation.

The prophylaxis of motion sickness was attempted by issuing medication for the passenger, with typewritten instructions to take one capsule 30 minutes before sailing time and then one every 4 hours until the five units of medication given each passenger were consumed. These instructions were repeated verbally to an assembly of all passengers with the added request that they report to sick bay if any illness developed. One thousand six hundred persons were observed in this phase of the study.

### RESULTS

*Therapeutic effectiveness.*—As shown in figure 1, those persons to whom no medication was given remained ill for the first 24 hours; by the end of 48 hours about 40 percent had recovered.

When a placebo (lactose) was given, 14 percent of the persons reported they had recovered at the end of 30 minutes and 46 percent

reported themselves cured in 4 hours when the second placebo was given.

Army Motion Sickness Preventive produced alleviation of symptoms in 17 percent at the end of 30 minutes and maintained a slow but steady rise until, at the end of the second day, 71 percent of the persons receiving the drug reported themselves to be symptom-free.

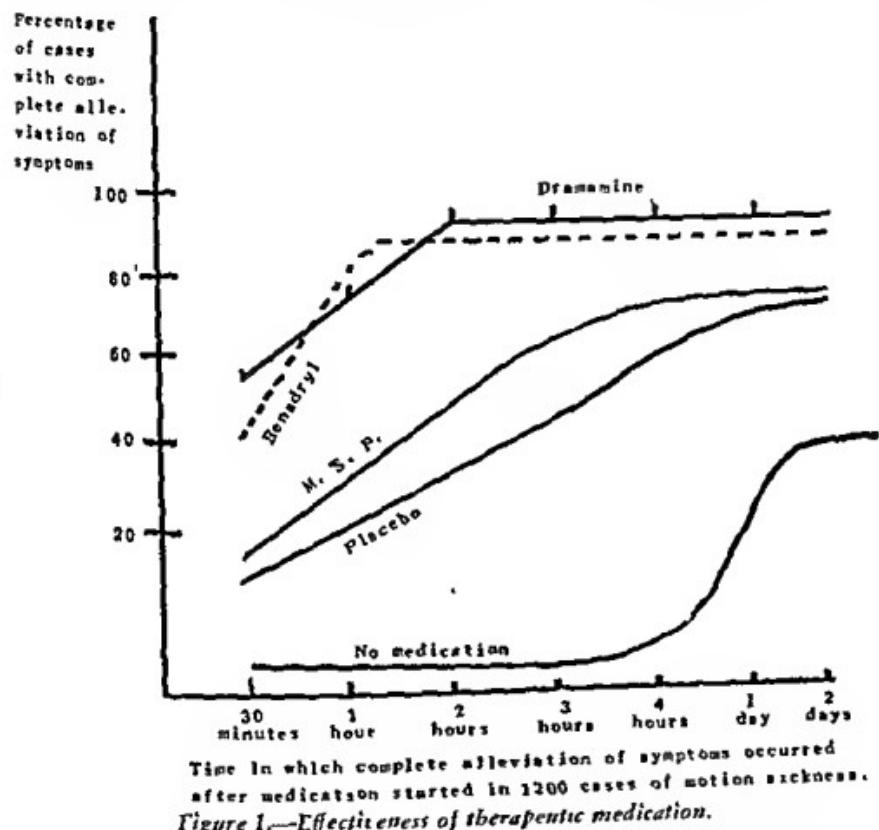
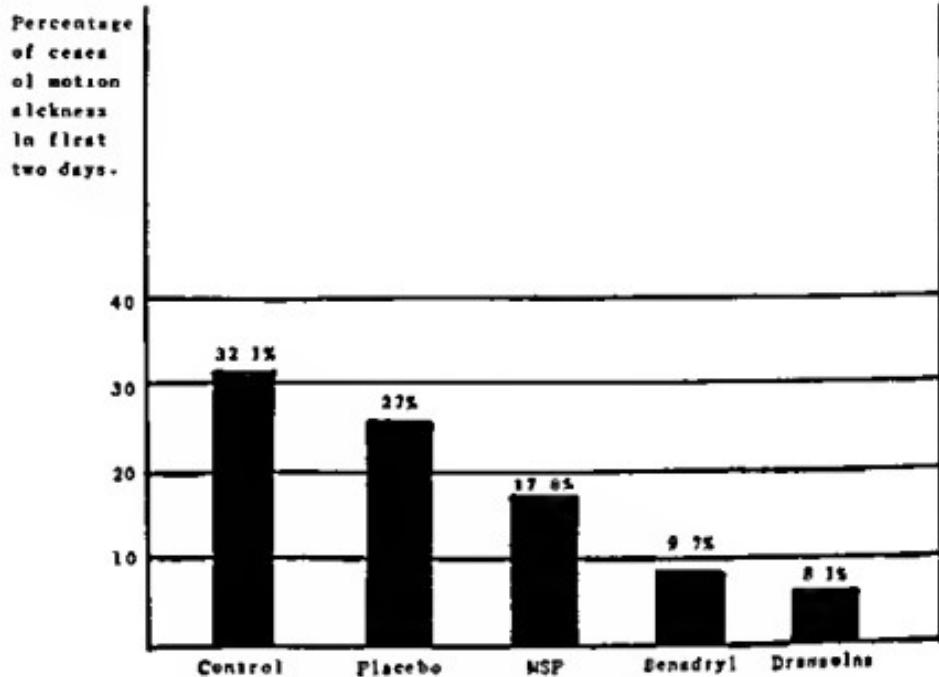


Figure 1.—Effectiveness of therapeutic medication.

Forty percent of those persons receiving 100 mg. benadryl stated that they were "cured" in 30 minutes whereas, at the end of 60 minutes, 82 percent were symptom-free. This increased to 88 percent at the end of 2 hours and no higher percentage of relief was obtained throughout the 2-day period of administration of benadryl.

Dramamine gave relief in 58 percent of motion sickness cases in the first 30 minutes, 76 percent in 60 minutes, and 91 percent in 2 hours. The figure of 91 percent was not exceeded during the 2 days of medication.

*Prophylactic effectiveness.*—Figure 2 shows that when no medication was given prior to or immediately after sailing, 32.1 percent of the passengers had symptoms of motion sickness. When placebos



Medication given 1/2 hour before sailing and then with each meal for 2 days. Each medication was given to 400 individuals.

Figure 2.—Effectiveness of prophylactic therapy.

were given, 27 percent had objective signs of seasickness. With M. S. P. only 17.8 percent became seasick. When benadryl was given as a prophylactic 9.7 percent had motion sickness. Dramamine protected all but 8.1 percent from motion sickness.

#### COMMENT

The difference in prophylactic value of 5.1 percent between placebo and no medication at all is not striking. However, the fact that 14 percent of those given a placebo after motion sickness developed recovered in 30 minutes and 60 were symptom-free at the end of 24 hours, whereas only 11 percent of those not receiving medication were symptom-free in 24 hours emphasizes the psychological aspect of motion sickness. This contention is supported by the three women who became nauseated while ascending the gangplank. These figures do not, however, support those who believe motion sickness to be merely a "state of mind"; the author is convinced that the psychological aspect plays a relatively minor role in motion sickness. Our results with M. S. P. were disappointing when compared with those reported by other observers working with this medication. In its favor is the absence of toxic symptoms observed by other investigators when the same dosage was used. The 29 percent of persons who had

not improved after 2 days of M. S. P. were given either benadryl or dramamine with complete relief of symptoms in a few hours in the majority of cases.

Benadryl proved more effective than dramamine in the period from 45 to 90 minutes after administration but was surpassed at that point and remained 3 percent less effective throughout the remaining time. Since benadryl has a hypnotic effect on many persons, it was at first thought much of its value was due to the extreme drowsiness produced. However, the administration of 2.5 mg. of benzedrine sulfate with each 50 mg. of benadryl eliminated much of the drowsiness and did not seem to change the therapeutic efficacy of the drug.

In our study of the drug, although dramamine did not prove as effective as reported by Gay and Carliner, it was dramatic in its alleviation of motion sickness. The high cost of dramamine and the relatively little difference in therapeutic value as compared to benadryl does not merit its exclusive use.

Rectal administration of dramamine was deemed necessary in only one case, a woman 5½ months pregnant who could not retain anything taken orally. A retention enema of plain water with 100 mg. dramamine gave relief in 70 minutes and the patient was continued on oral therapy. In most cases, immediate repetition of the medication after vomiting was sufficient to control the motion sickness.

In addition to the treatment of the usual cases of motion sickness, seven women, all of whom were less than 5 months pregnant reported to sick bay with a history of vomiting several times daily before coming aboard ship and the condition had persisted. Two of the women had been receiving injections of pyridoxine without complete relief, the others had not consulted a physician. Both dramamine and benadryl proved effective in five of the seven cases. Either dramamine or benadryl was given until the vomiting ceased, the drug withdrawn and placebos given until the vomiting recurred, and then the other drug given in turn. One of the women responded only to dramamine and one did not respond to benadryl, dramamine, or pyridoxine; she was transferred to a naval medical facility at the first port. It was noted that none of the women benefited by the placebo which was substituted for the drugs without their knowledge.

#### TOXICITY

No toxic reactions were seen from M. S. P. although the literature states that hallucinations, mental cloudiness, change of heart rate, dry mouth, and cessation of sweating are all commonly found with over dosage.

No severe toxic symptoms resulted from benadryl; however, drowsiness was noted in 58.2 percent of a selected number of persons receiving

# Progeria in the Adult (Werner's Syndrome)

## Report of a Case

B. RENNEY FORCE, Lieutenant (JG) U. S. N.<sup>1</sup>  
CLIFFORD P. POWELL, Captain (JG) U. S. N.<sup>2</sup>

PATIENTS who look 20 to 30 years older than their stated age bring several conditions to mind, such as arteriosclerosis, Star-monds' disease, carcinoma, emphysema, and malnutrition. A group of syndromes associated with premature aging are those of Werner (progeria of the adult), Rothmund, and Hutchinson-Gilford.

Thannhauser (1) reviewed these entities completely and stated that more cases will be found if the condition is kept in mind. Other problems of interest arise: What comprises "growing old," the nature of arteriosclerosis, and the effects of the dynamic equilibrium of the endocrine systems?

Werner's syndrome was first described in 1904 by Otto Werner and named in 1934 by Oppenheimer and Kugel (2) who first reported the condition in the American literature. It has some or all of the following characteristics: (a) shortness of stature; (b) canities (premature graying of hair); (c) premature baldness; (d) scleropoikiloderma; (e) trophic ulcers of the legs; (f) juvenile cataracts; (g) hypogonadism; (h) tendency to diabetes; (i) calcification of blood vessels; (j) osteoporosis; (k) metastatic calcifications; and (l) tendency to occur in siblings. These were evident in members of family "K" as related by Werner (3). A typical case has early graying, premature baldness, tight atrophic skin over ankles, hyperkeratosis of the feet, leg ulcers, cataracts before the age of 30, a high-pitched voice, short stature, and some endocrine disorder as manifested by an enlarged thyroid. In general, signs of arteriosclerosis and premature aging are present. The condition is considered to be a recessive heredofamilial disorder with skin manifestations of "heredofamilial atrophic dermatosis with skin ulcers." Formes frustes may occur.

<sup>1</sup>U. S. Naval Hospital, Philadelphia, Pa.

## CASE REPORT

P. B., a 45-year-old white man, a statistician by profession, was admitted to the United States Naval Hospital, Philadelphia, Pa., in March 1948, complaining of pain and ulcerations of both lower extremities, associated with intermittent attacks of pain in various joints.

*Past history.*—He was apparently well until 4 years ago while serving in the United States Army, at which time he was admitted to a hospital in Corsica for arthritis and arteriosclerosis. He had had intermittent pain in his legs and joints with leg ulcers that had failed to heal completely during the year prior to admission.

Between 1941 and 1947, he gradually became totally bald and in 1945 all the pubic and axillary hair disappeared (fig. 1). During this time many characteristics of aging were noted (figs. 2 and 3). He complained of generalized weakness and noticed a considerable loss of energy and sense of well-being during the past year.

*Family history.*—His mother and father died at ages 67 and 78, respectively. He has four brothers living and well, and a daughter by a previous marriage who is also well. No member of the family in any generation has had a similar condition so far as is known.

*Physical examination.*—The patient is a thin, short, white man appearing about 70 years of age. His skin shows generalized atrophy and wrinkling, most noticeable over the legs and hands with some thickening around the ankles. Small fine white scales are present on most of the skin. He has complete alopecia. Numerous wrinkles are present about the eyes, associated with folds of loose atrophic skin hanging from the submental area. The lower extremities are a violaceous color; numerous healed and partially healed small ulcers are present on the



Figure 1.—Complete alopecia.



Fig. 2.



diomes it is the consensus that they result from multiple germinal defects because they present recessive characteristics, are of heredo-familial occurrence, and because endocrine manifestation is only one of the multiple features.

#### SUMMARY

A case of possible atypical progeria in a man 45 years of age appearing to be 70 is reported for the purpose of stimulating attention to the syndrome of premature aging. It is believed other cases will be reported if the condition is kept in mind.

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# Urinary Excretion of 17 Ketosteroids in Tetraplegic and Paraplegic Patients

## A Preliminary Metabolic Report

ALBERT W. COOK, Lieutenant, junior grade (MC) U. S. N. R.<sup>2</sup>

HAROLD A. LYONS, Commander (MC) U. S. N.<sup>3</sup>

EVER since Selye (1) introduced his theory of the adaptation syndrome, he and others have attempted to explain various conditions by this hypothesis. The chronic paraplegic patient with persistent bedsores, genito-urinary tract infections and renal calculi, gastrointestinal ulcers, and other lesions represents a situation when an organism is subjected to repeated stimuli over a prolonged period of time. The occurrence of systemic deterioration in these patients concomitantly with the appearance of such stimuli provoked the suggestion (2) that a humoral mechanism might be involved. Our interest in this problem was also stimulated by the fact that post-mortem examination of several of these patients showed considerable deposition of a substance resembling amyloid in the adrenal glands (3), and in each instance the cortex of the glands was most severely affected.

We became interested in the urinary excretion of the 17 ketosteroids in this type of patient as a direct result of these observations. In addition, it was believed that this would be an opportunity to evaluate the physiologic effect of interruption of the spinal cord on the excretion of these same products. Such observations seemed particularly pertinent since Bustamante (4) postulated a direct neural connection between the hypothalamus and the gonads, even though Reitman (5) recently discounted any such mechanism when he discussed the changes in the 17 ketosteroid excretion following frontal lobotomy.

<sup>1</sup> U. S. Naval Hospital, St. Albans, Long Island, N. Y.

## MATERIAL AND METHODS

The determinations of the 24-hour urinary excretion of the 17-ketosteroids (total neutral fraction) were performed by the Sloan-Kettering Institute, Section on Clinical Endocrinology, Memorial Hospital, New York, according to the method outlined by Engstrom (6). The results of this study in 21 patients, all men, are listed in table 1. The age of each patient is also included because of the difference in excretion of these substances in various age groups (7).

TABLE 1.—*Urinary excretion of 17-ketosteroids in tetraplegic and paraplegic patients*

Case No.	Age	Spinal cord level	Ketosteroid excretion (mg 24 hr)		Case No.	Age	Spinal cord level	Ketosteroid excretion (mg 24 hr)	
			Date	Amount				Date	Amount
1	24	C1	10-29	3.2	10	36	T5	12-17	13.4
			11-29	8.8				11-3	10.3
2	22	C6	12-	14.6	12	26	T10	12-17	8.6
			10-29	12.6				10-29	8.3
3	27	T9	11-12	15.0	13	36	T11	11-24	5.7
			11-31	6.4				10-29	4.0
4	21	C6	10-29	14.0	14	26	T1	11-29	16.6
			11-29	1.50				12-17	8.4
5	31	T12	12-17	23.6	15	23	T9	11-5	21.4
			11-12	19.0				11-30	16.0
6	24	T12	11-30	17.4	16	23	T12	10-29	7.1
			10-29	9.6				11-29	7.6
7	21	T7	11-20	11.0	17	23	L1	11-5	10.10
			11-5	21.4				11-21	24.0
8	25	D10	11-29	14.6	18	21	T12	11-11	11.21
			10-29	8.0				11-1	10.9
9	23	T12	10-29	1.1	20	25	C6	11-1	10.9
			11-17	8.6				11-11	9.9

Note.—The normal range of excretion in the urine of the 17-ketosteroids (TNEF) for the age group 20 to 40 years is 8.1-22.6 (7).

## RESULTS

The total number of determinations have been recorded, but it should be noted that some results (29 October 1948) tend to be very low. Since these were the first collections and determinations that were done and, particularly, since they were at great variance with other results in the same patient, we believe that no significance can be attached to them. They are reported for completeness only. The remaining values, however, are not indicative of an abnormal excretion of these substances, even though several reports seem to be lower than normal. This assumption is entirely warranted when it is remembered that there is a daily variation in these figures in the individual and that unless a result is repeatedly constant no real value can be attached to it (8).

Since both the testicles and the adrenal cortex are concerned with the appearance of these excretory products in the urine, case No. 13 was of special interest. In this instance the patient had had a bilateral orchidectomy for carcinoma of the prostate with metastases

to the spine. This result must also be considered normal in the light of Kimeldorf's work on rabbits (9). He found that there was a 41 percent decrease in the excretion of the 17 ketosteroids (TNF) in the urine following castration.

#### DISCUSSION

It is apparent that prolonged interruption of spinal cord function in man has no significant effect on the excretion of 17 ketosteroids (TNF) in the urine. It is surprising, however, that significant decreases were not noted in some instances; namely, in those patients who have had repeated infections and painful episodes as well as those with extreme liver disease (7).

Although further studies on the adrenal cortical function of these patients are in progress and still incomplete, these studies seem to indicate that hypofunction of the adrenal cortex is not associated with the so-called "paraplegic" state.

#### SUMMARY

The chronic paraplegic excretes a normal amount of 17 ketosteroids in his urine over a 24-hour period. The results reported here tend to exclude adrenal cortical insufficiency as the cause of the failure of some of these patients to react adequately to distressing stimuli.

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# Circumcision of the Newborn

## An Exact Technique for the Use of the Gomco Clamp

WILLIAM W. MANSON Lieutenant Commander (M.C.) U. S. N.<sup>1</sup>

FROM 15 March 1948 to 15 March 1949, 387 circumcisions on newborn infants were performed by the author and his associates with the Gomco clamp. During the first half of this period, 2 circumcisions had to be repeated because of postoperative phimosis caused by the removal of too little tissue at the initial operation. Since then an exact technique for the use of the Gomco clamp has been followed and there have been no postoperative complications. Although Pugh (10) condemns any type of preputial clamp because of the danger of secondary bleeding, there were no cases of postoperative hemorrhage in the entire series performed with the Gomco clamp.

Wolbarst (12), after an extensive study, concluded that at least 225 deaths from penile cancer and approximately twice as many non-fatal cases could be prevented annually in the United States by circumcision of all male children in infancy. Phimosis was universally recognized as the most important factor in penile cancer. We advise circumcision of all infants whose foreskin cannot be dilated sufficiently to permit easy retraction over the glans penis. The operation is performed on the fourth day of life but deferred if the infant weighs less than 5 pounds 8 ounces, or is clinically jaundiced.

A review of the literature reveals a variety of circumcision clamps in use. In 1907 Borey (4) described a clamp with much the same principle as the Gomco clamp but, from his description, less sturdy and more complicated. Since then many authors (1) (2) (3) (7) (8) (9) have described circumcision clamps, guides, and forceps of varied simplicity and ingenuity.

In 1935, Yellen (13) described a clamp developed by Aaron Goldstein, of Buffalo, N. Y. and used successfully in over 500 newborn circumcisions. In 1939, Brodie (5) reported 300 cases of infant circumcision with the Yellen clamp. According to a personal communication from the manufacturers, the present Gomco clamp is the same

<sup>1</sup> George F. Geisinger Memorial Hospital, Danville, Pa.

clamp with a few modifications that was described by Yellen. This is the clamp that was used in our 387 circumcisions.

#### TECHNIQUE

A mosquito forceps is attached to each side of the tip of the foreskin. The point of a third mosquito forceps is then introduced between the foreskin and the glans as shown in figure 1. By opening this forceps and rotating it on its longitudinal axis the adherent mucosa is partially separated from the glans penis.

A dorsal slit is then made with its apex 0.75 cm. distal to the corona, the outline of which may be seen through the foreskin when it is stretched slightly by traction on the mosquito forceps attached to the lateral margins of the foreskin (fig. 2). Dorsal veins in the foreskin may be readily seen and avoided when making the dorsal slit, thus the blood loss is negligible.

The mosquito forceps are then removed from the lateral margins of the prepuce and the prepuce is retracted back from the glans penis to completely free all the adhesions between the mucosa and the glans. All the smegma is carefully removed by wiping the coronal sulcus with a gauze sponge.

The cone of the Gomco clamp is then placed over the glans penis and the foreskin is pulled out over the cone. It is important to make certain that mucosa as well as the foreskin is over the cone. Two sizes of cones, a small (diameter 1.0 cm.), and a large (diameter 1.2 cm.), have been found to suffice for all newborn circumcisions.

The hole in the plate of the Gomco clamp is then easily slipped over the foreskin-covered cone and



*Figure 1.—Use of mosquito forceps.*



*Figure 2.—Dorsal slit.*

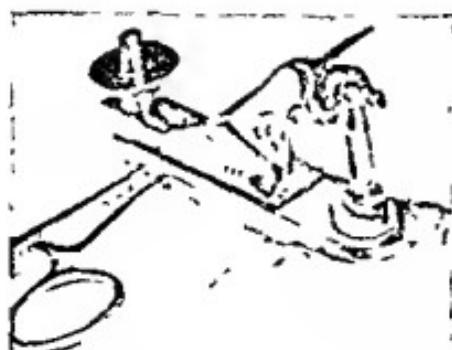


Figure 3.—Gomco clamp in place

to the margin of the hole in the plate as shown in figure 3.

After a 5-minute wait for pressure hemostasis, the foreskin is cut off flush with the margin of the hole in the plate. The clamp is then unscrewed, disassembled, and removed. As recommended by Walker (11) enough foreskin is left to cover the corona during relaxation of the penis (fig. 4). Figure 5 shows the foreskin retracted into the position in which it is left during the healing which prevents reforming of adhesions between the mucosa and glans.

The dressing used is similar to that described by Clarke (6) for adult circumcisions. The penis is wrapped in vaseline gauze and covered by a 4-inch square gauze pad, one layer of which contains a hole through which the penis is placed using the intact layer of gauze as a cover. The open ends of this dressing are tucked up under the infant's bellyband to complete the dressing.



Figure 4.

the foreskin pulled up evenly around the cone with plain thumb forceps. Reaching through the hole in the plate with mosquito forceps, attaching sutures to the foreskin to pull it through the hole in the plate, or other complicated procedures are not necessary. When the plate and the cone are assembled properly and screwed firmly into place, the apex of the dorsal slit should be 0.25 cm distal

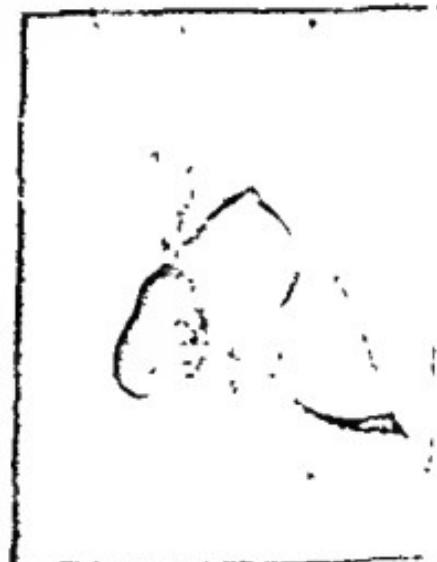


Figure 5.

## CONCLUSIONS

1. Circumcision of the newborn is indicated in all cases in which the foreskin cannot be readily dilated and retracted over the glans penis.
2. Circumcision should be performed on the fourth day of life. The operation should be deferred in jaundiced infants and in infants weighing less than 5 pounds 8 ounces.
3. Routine performance of a dorsal slit results in negligible blood loss and permits an exact, measurable technique for the application of the Gomco clamp.

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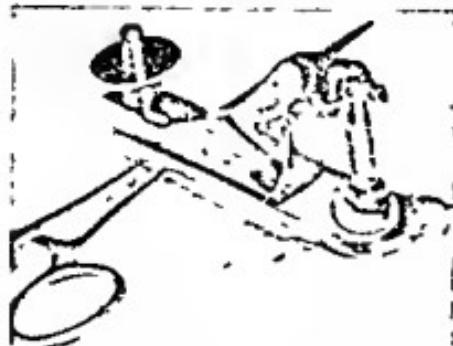


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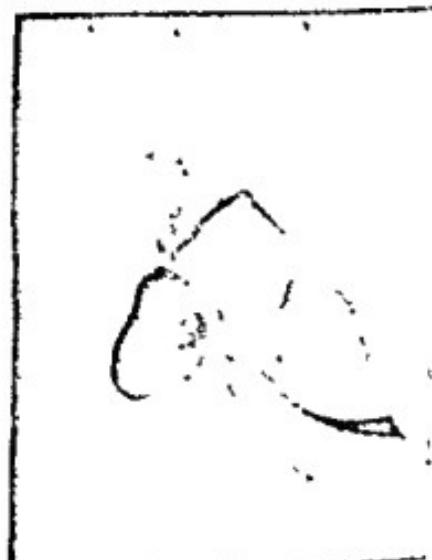


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nearly equal at all frequencies—fairly common); (c) falling curve (usually starting at 0 to 15 db for the frequencies 250 (256), 500 (512), and 1,000 (1,024) c/s<sup>2</sup> then dropping gradually or suddenly to levels greater than 20 db—very common); and (d) rising curve (the lower frequencies show the greater loss gradually rising to normal or slightly below normal—this type is relatively rare). Probably the most common exception to these classes is the pure tone audiogram with a normal curve, except for a dip at 4,000 (4,096) c/s varying from 20 to 60 db. This dip is of little or no significance. Another exception that is relatively rare is a U-shaped curve. It has normal values at each end of the sound spectrum, with values symmetrically falling in the middle and again symmetrically rising to normal.

The frequencies we are most concerned with in relation to speech are 500, 1,000, and 2,000 c/s. This is the speech range which extends from about 350 to 3,000 c/s. In general, if an average of these three frequencies is taken, the resulting figure will give a close approximation of the loss for speech in decibels. Hearing losses should be recorded as decibels of loss rather than in percentage. It is a mistake to attempt to interpolate between the 5 db steps on the audiometer since the resulting figure is merely a guess and it is not necessary to record steps of less than 5 db. If there is a question of the threshold not being as little as 30 and perhaps not as much as 35 db then 35 should be recorded.

Deafness may be classified as conductive, perceptive, and mixed. Conductive deafness is caused by a barrier to the conduction of air-borne sound from the external ear through the middle ear to the cochlea. Any sound getting through to the cochlea is picked up, analyzed correctly, and carried to the central nuclei normally. Examples of this are otosclerosis, middle ear deafness, and foreign bodies in the external canal. Perceptive deafness is caused by malfunction of the receptive mechanism of the inner ear or any dysfunction of the auditory nerve trunk, cortical nuclei, and auditory area. Sound arrives at the cochlea normally, but at this point perception is faulty for both intensity and discrimination. Examples are deafness caused by acoustic trauma; toxic conditions such as quinine, nicotine, and streptomycin poisoning; meningitis; acoustic nerve tumors; Ménière's syndrome; presbycusis; and trauma to the auditory cortex. Mixed deafness is a combination of the preceding types.

In general, patients with a hearing loss in the better ear of less than 25 db in the speech range will have little difficulty performing military duty. There are patients, however, whose hearing loss lies between 20 and 30 db, who will complain of difficulty in situations which re-

<sup>2</sup>Cycles per second.

quire acute hearing, such as conferences, lectures, theaters, parties, and noisy places, particularly groups in which several conversations are carried on simultaneously. The treatment of this type of patient is also dependent on the amount of loss in the most severely affected ear. If the hearing is nearly equal in both ears difficulty will be less than if the poorer ear is much worse than the better ear. The treatment will be determined by the type of hearing loss also. A patient with a predominantly conductive loss will have relatively little trouble as compared with a patient with a perceptive loss, particularly if the pure tone audiogram shows a steep loss following 500 to 1,000 c/s.

This can be explained as follows: A patient with a conductive loss needs only an increased intensity to pass the obstruction to the air-borne sound, after which the cochlea functions normally. In contrast, in perceptive deafness the cochlea is faulty, and although increased sound is perceived this sound is not analyzed correctly and the result is summed up by the statement, "I can hear you but I cannot understand what you are saying." Analyzing further, the vowels carry the strength of the words but discrimination is controlled by the consonants. The vowels are made up of frequencies below 1,500 c/s and the consonants above 1,500 c/s. This explains why some patients have more difficulty than others and why some words and voices are more easily understood than others.

Speech reception audiometry seeks a person's auditory threshold and discriminatory power for speech by the use of special word lists presented through a controlled amplification system. This may be conducted by a monitored live voice over earphones or in a sound-controlled situation without earphones. It has no relation to the low conversational voice or whispered voice tests.

After a diagnosis and evaluation have been made, and all definitive treatment has been accomplished with no improvement, rehabilitation is mandatory. Rehabilitation of the deafened soldier is a specialized job and should be attempted only by trained personnel. At present the Army has the world's finest center for rehabilitating deafened persons. Its purpose is to study, evaluate, and rehabilitate deafened soldiers in such a way as to make them useful to the Army. Any soldier who complains of difficulty with his hearing should be studied carefully and not pushed aside as a malingerer or chronic complainer. If an audiogram shows him to have a loss of 25 db or more in the speech range he should be sent to the Audiology and Speech Correction Center at Walter Reed General Hospital for study. Conversely, if his hearing loss is less than 25 db, or he has one ear with less than 25 db loss, there is no need for rehabilitation. Severe deafness in one ear, with better than 25 db in the good ear, will cause little or no disability; in the past 2½ years many patients have been sent to this

center needlessly because of ignorance of this fact. On the other hand, there are many who have not been sent here because of improper study or no study at all.

This center has returned to duty patients of ranks from privates to lieutenant generals with benefit to the patient and to the military servicee. Patients often enter this clinic tired, bewildered, and psychologically beaten but leave after a few weeks with a new understanding of their problems and a completely renewed confidence in their ability to perform their military duties. It is now the policy of the Army to send back to duty any patient whose hearing is improved to 20 db or better by a hearing aid although these men cannot perform combat duty. The instrument would break down under combat conditions, but there is no reason why such men cannot do all other types of duty. It behooves the officers responsible for assigning these men to assign them to noncombat duty. Today's armies are highly specialized, and many men who have been deafened in the Army have experience that can be useful if they are properly assigned. On the other hand, these same soldiers without rehabilitation are less useful, and because of fear of disfavor from a misunderstanding superior officer may neglect to report their progressing disability.

The deafened person develops a peculiar psychology. He becomes an introvert and seeks to hide his disability. Many men who are deafened have been considered disciplinary problems because of failure to hear commands or instructions. Rehabilitation involves more than issuing a hearing aid that is nothing more than an amplifying system reduced to a convenient size. Because deafness is largely influenced by the patient's psychologic make-up and response to amplified sound, just any device will not answer the purpose. A fitting procedure is necessary to determine which, if any, of the numerous makes will give the best results as determined by controlled tests. After this the patient is given a training course in the use and care of the aid. This course is designed to show the patient how to get the most out of his instrument and to convince him that by its proper use he will overcome most of the difficulties he first encountered. Added to this are courses in lip reading, in increasing powers of observation, and in correcting speech defects. Each has its share of psychotherapy also.

This center is equipped to deal with any type of speech defect, including stuttering, aphasia, defects caused by articulatory dysfunction (whether traumatic or psychologic), defects resulting from deafness, and esophageal speech training after laryngectomy. The staff of this center has become expert in making decisions concerning the deafened soldier's ability to perform his military duties and with few exceptions any man returned to duty from this center can do mili-

tary duty if he so desires. Patients are referred to this center after being studied by the otolaryngologist of the referring hospital. If a patient is considered to have defective hearing within the limits previously outlined, application is made through the regulating medical officer, Office of the Surgeon General, for transfer to Walter Reed General Hospital. All problems regarding defective hearing must be decided by the Audiology Service, Walter Reed General Hospital (5).

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### Scrub Typhus in Assam and Burma<sup>1</sup>

The incidence of scrub typhus on the basis of case rates and isolation of rickettsial strains from chiggers and tissues varies in 9 areas near Lele, Assam. The percentage of chiggers that were *Trombicula delenensis* (Wulch) in samples from these areas varied from 13 to 96 percent. *T. delenensis* was most prevalent at the 3 areas undoubtedly most dangerous with respect to scrub typhus, constituting 60, 74, and 96 percent respectively of all chiggers sampled, and was least abundant in areas reporting no cases and considered relatively less dangerous. Samples from the hyperinfective areas were most likely to consist entirely of *T. delenensis*. In one very dangerous area, 50 of 75 samples consisted entirely of this mite. In the less infective areas *T. delenensis*, reported in every batch of chiggers from which rickettsial strains were isolated, never appeared in more than 10 percent of the samples.

In the most dangerous area 12 mite strains were isolated in 30 attempts, and over 90.5 percent of the chiggers sampled were *T. delenensis*. In 48 instances, all the mites sampled were of this species. On the basis of abundance, its habits, and its chiggers, and because of the strains isolated from its chiggers and tissues, *Rattus flavigaster panamensis* is considered to be important in the epidemiology of scrub typhus in the Lele area. Shrews are involved in the epidemiology of this disease. Data were presented indicating that *T. delenensis* was more abundant on various species of rats taken in grassy terrain and scrubby growths along the roadside in North Burma than on hillsides of the contiguous primary jungle. *T. delenensis* was much more prevalent in the wet season than in the dry season, although it was found throughout the year.

<sup>1</sup>TRAVIS, R.: Observations on tsutsugamushi disease (scrub typhus) in Assam and Burma. *Abstr. Am. J. Hyg.* 50: 261-270, Nov. 1949.



# Pathologic Features of Yellow Fever in Panama

NORMAN W. ELTON, Lieutenant Colonel, MC, A. U. S.<sup>2</sup>  
CARL M. JOHNSON, M.D.<sup>1</sup>

THE continuing occurrence of deaths from yellow fever among the native farming population in the Republic of Panama will afford an unusual opportunity to study the pathologic features of this disease, and to observe the involution of the liver lesion and the progress of the lower nephron (hemoglobinuric) nephrosis, when death is delayed.

Although an intensive rural vaccination program has been completed by the Health Departments of the Republic of Panama and the Panama Canal, the migration of farmers from many remote localities of the interior to the yellow fever zone, particularly to the newer agricultural settlements along the Transisthmian Highway, makes it difficult to eradicate the disease. One recent victim is known to have refused vaccination. Since the initial outbreak in November-December 1948, there have been three additional proved deaths from yellow fever among unvaccinated farmers working in new clearings or engaged in felling trees. Two of these occurred in August and one in September 1949. During the rainy season, and particularly in November and December, with the last flurry of insect activity before the dry season, an increase in deaths is anticipated. Specimens from all organs at autopsy are now being referred to the Board of Health Laboratory, Gorgas Hospital, for diagnosis and complete histologic examination.

Ranking high among the relatively recent discoveries pertaining to yellow fever is the characteristic microscopic liver lesion, one of the most pathognomonic histologic patterns to be seen under the microscope. Stoke's discovery that the virus of yellow fever could readily be transmitted to the *Macacus rhesus* monkey initiated the chain of events leading to the discovery of the sylvan origin of the disease. The modification of the technique of the Pfeiffer phenomenon to the mouse-protection test provided a practical diagnostic test

<sup>1</sup> Board of Health Laboratory, Gorgas Hospital, Ancon, C. Z.

and the development of an effective vaccine provided a practical control measure.

Of importance was Hoffmann's (1) recommendation, in 1928, that the histologic specificity of the liver lesion of yellow fever be made the basis of routine diagnosis. The pathologic findings in yellow fever may have been well known to a few investigators, but they certainly were not common knowledge. A clear description did not appear until 1929 when Penna and Figueiredo (2) stressed the differential diagnostic significance of the lesion. Klotz and Belt (3) summarized the liver findings in 1930. Councilman (4) had earlier described



Figure 1.—Liver in delayed death. Councilman's material from necrotic polygonal cells being extruded into sinusoids.



Figure 2.—High-power appearance of an area rich in Councilman bodies.

the characteristic liver necrosis that is now associated with his name, but he did not recognize the lesion as specific for yellow fever. In 1912, da Rocha Lima (5) described midzonal necrosis as characteristic of yellow fever, and this concept dominated the literature for many years without proper evaluation of the pathognomonic hyaline Councilman bodies. Implementation of Hoffmann's recommendation was effected in Brazil in 1930, and the diagnostic value of routine histologic examination of the liver was quickly established. The Viceroy Service of Brazil, Bolivia, and Colombia contributed materially to the discovery of the sylvan form of the disease when Soper, Rickard, and Crawford (6) observed its reappearance in the absence of *Aedes aegypti* mosquitoes in the rural area of Espírito Santo, Brazil, in March 1932, and in the isolated village of San Ramon, Bo-



Figure 3.—Typical midzone necrosis in yellow fever

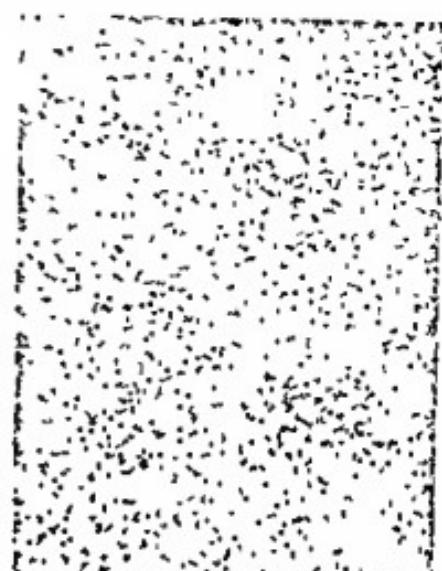


Figure 4.—Peak of degeneration in Councilman bodies, with midzonal hemorrhage in liver lobules.

livia, in May 1933. The initial diagnosis of the recent Panamanian cases (7) was as easy as Hoffmann predicted in 1928, but was materially facilitated by familiarity with a slide prepared in 1941 from a Bolivian specimen and used since 1942 in a reference set on the pathology of tropical diseases. With such a guide the diagnosis was undisputable.

Histologically the gross pattern of the liver lobules is not materially disturbed although the cords are jumbled. Central veins and portal glands are readily distinguishable. There is no central necrosis that disturbs the outlines of the central veins. Necrosis involving the midzones of the lobules extends inward to two or three rings of cells bordering the central vein and to from one to four rows of cells which demarcate the perimeter of the lobules; these cells show minimal involvement. This necrosis is distinctive not only in its distribution, but also in its character. Councilman bodies, consisting of discrete, pale, eosinophilic masses of polygonal cell cytoplasm, are sprinkled in a salt-and-pepper fashion throughout the lobule, contrasting in color with the basophilic cytoplasm of the uninvolved cells and the remnants of partially involved cells (figs. 1, 2, 3, and 4). Some polygonal cells show only partial hyaline necrosis without detachment of the eosinophilic portions of their cytoplasm.

The degree of this necrosis varies in different lesions. In some, practically no normal polygonal cells remain and the entire lobule is diffusely involved, including the central and peripheral rings of cells.



Figure 5.—Hemoglobin casts in collecting tubules of kidney in yellow fever.



Figure 6.—Higher magnification of hemoglobin casts.

In others the necrosis is light and scattered, attaining its maximum density in the midzones. Polygonal cells showing the change in the Councilman bodies are usually wholly involved at the peak of the process—their shrunken nuclei often resembling a crescent on the cell edge, or the nuclei are missing. These cells appear as distinct, irregular, pink hyaline spheres or ovoids, and are often fragmented, resembling red blood cells. In the most recent involvement the liver shows midzonal hemorrhage, the red blood cells being distinguishable from the Councilman's fragments by their orange color.

Fatty degeneration is diffuse in character, but its degree in some cases varies inversely with the degree of degeneration of Councilman bodies, while in others the two degenerative processes coexist. There is some tendency for the fatty degeneration to spare the central zones. Nuclear inclusion bodies have not yet been demonstrated, presumably because of partial neutralization of the virus by the development of a protective antibody before death. Portal periductal and perivasicular lymphocytic infiltration is common and may be associated with polymorphonuclear cell infiltration. In a recent case, in which death was delayed until the tenth day of illness, the superimposed factor of a peripheral zone necrosis with extensive polymorphonuclear cell infiltration accompanied the typical liver



*Figure 7—Hoffmann body in a proximal convoluted tubule of kidney. This is a characteristic finding in yellow fever.*

lesion was seen. In this case the kidneys also showed a fully developed lower nephron nephrosis, with the typical orange casts of hemoglobin (figs. 5, 6, and 7).

Although the liver lesion of yellow fever is described as specific and is not easily confused with other lesions, such as those of epidemic hepatitis, much still remains to be learned about it. It is curious that under certain circumstances in deaths from burns, a lesion said to be indistinguishable from it has been reported—an observation that may be of great importance in determining the pathologic changes in these entities (8). The mechanism whereby

the liver is cleared of Councilman's material (if the patient survives to the tenth day or longer, when the chief obstacle to recovery is the lower nephron (hemoglobinuric) nephrosis) is also deserving of careful study. In one of the cases occurring in August 1940, movement of this necrotic material into the sinusoids was noted exactly as Councilman described it in 1890. The first case in the series reported by Elton and Herrera (7) did not present a typical histologic liver lesion, yet conformed epidemiologically, clinically, and pathologically with yellow fever. Future studies may throw light on the existence of possible anomalies in the histologic pattern of the entity or, perhaps, of other sylvan diseases simulating yellow fever in all respects except for the liver lesion.

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**EXPLORATIONS INTO THE PHYSIOLOGIC BASIS FOR THE THIRAPATHI USE OF RESTRICTIVE BANDAGES IN THERMAL TRAUMA. AN EXPERIMENTAL STUDY,** by Frederick W. Rhinelander, M. D.; John L. Langolir, M.D.; and Oliver Cope, M.D. Archives of Surgery 59: 1056-1069, Nov. 1949.

Many authorities have advised pressure dressings and plaster casts for the local treatment of burns because these tend to limit swelling of the wound or, as in the case of plaster casts applied immediately after injury, prevent swelling without interfering with arterial blood flow, oxygenation, or nutritional environment of the tissues. Occlusive pressure dressings restore tissue pressure which is normally dependent upon an intact integument. Thus, pressure dressings aid venous return flow and limit both venous and lymph stasis. Pressure dressings are of value in preventing loss of plasma from the circulation, promote comfort, and so reduce the incidence of wound infection.

The experimental work of the authors emphasizes the clinical benefit derived from pressure dressings, but points out that although such treatment probably reduces the loss of plasma into the burn wound their findings were not conclusive. They noted that plasma from a burn wound is not sufficiently reduced by a plaster cast for the lymphatics to be able to carry and return it all to the blood stream. The lymph therefore piles up in the interstitial spaces proximal to the cast, and edema slowly reaches the volume it would have been had plaster cast dressing not been applied.

The clinical benefits which accrue from the use of restrictive dressings come from the immobilization of the wound. Motion of the burn wound increases the lymphatic flow and displaces edema proximally in the interstitial spaces; both have the effect of lowering tissue pressure in the wound and permit augmented seepage from the capillaries.

Restrictive immobilizing dressings are indicated in the care of burn wounds but they must not be used with the idea that the need of plasma to prevent shock will be reduced. The improper application of a plaster dressing carries with it the danger of gangrene.—*Abstract.*



# About the Army Medical Department

PART I ROMPESOX, Colonel, MC, U. S. A.<sup>1</sup>

In a previous article<sup>2</sup> a report of a visit to a number of stations in the United States was made. The questions that were asked by Medical Department personnel at that time were tabulated and answered in the light of current knowledge. Subsequent correspondence indicated that personnel in those places not visited also had many of the same questions in mind and appreciated the discussion. We have recently paid a similar visit to medical installations in Hawaii and the Far East. In Hawaii, the entire medical service for the Army is rendered by Tripler General Hospital. The Navy and Air Force have small dispensaries from which consultations and patients needing hospitalization are sent to Tripler General Hospital. Army, Navy, and Air Force officers comprise the staff at that hospital. The excellent working relationship between them leaves little to be desired. Congeniality and cooperation in professional as well as administrative relations were abundantly in evidence. A council composed of senior medical officers of the Army, Navy, and Air Force meets periodically to iron out minor difficulties and to formulate operating policies.

In Japan, the medical service is widely dispersed, corresponding to the distribution of troops. All hospitals, with one exception, are in permanent prewar buildings, many of which were originally constructed as hospitals. The medical service, without exception, was of the highest order. The relationship between Medical Department personnel and commanders whom they served was beyond reproach. Commanders everywhere had the highest praise for their medical service. Wives of officers and enlisted men in Japan were well satisfied if not enthusiastic about their living conditions. Much has been done in the way of stocking post exchanges with the necessities of life from the United States. A busy social life is carried on and a reasonable amount of household help is available. Many of the wives have

<sup>1</sup>The Personnel Division, Office of the Surgeon General.

<sup>2</sup>Bulletin of the U. S. Army Medical Department, May 1949, pp. 271-274.

taken great interest in Japanese culture and their conversation is most stimulating. Many have obtained, for reasonable prices, rings, silverware, china, and cloisonné, damascene, and lacquer articles produced in Japan or China.

In Okinawa there is a scarcity of permanent buildings but construction is in progress. Nowhere is one confronted by a greater challenge to accomplishment. The spirit with which the personnel there are working to improve conditions is heartening. Attractive surroundings and efficient service must surely result from their endeavors. The wives there have entered into this spirit and are proving themselves a credit to their heritage.

In the Philippines, Army and Air Force medical personnel are jointly rendering medical service at Clark Air Force Base. Army units are rapidly finishing their work and leaving the Philippines. The Army continues to operate a hospital at Fort McKinley for the Philippine Scouts. All personnel continue to enjoy their service in the Philippines as they have in the past.

Our Navy operates the only hospital in Guam, and Army and Air Force medical personnel serve on the staff of this hospital. Army dispensaries are operated by Army medical personnel in an efficient manner and consultations are referred to the naval hospital. Morale is high and the joint operation is completely successful.

Medical personnel who so desired were interviewed at every station visited. Many had personal problems and no attempt will be made to enumerate them, although many others may have similar problems. Some of the questions of a general nature are discussed here.

**Q.** What will be the result of the closure of hospitals in the United States on the training program?

**A.** There are sufficient approved spaces in the remaining hospitals to accommodate all residents and interns. Coming in the middle of a training period—since only emergency cases could be admitted after 15 February 1950—the personal inconvenience of some officers in the program was unavoidable. The Army can fulfill its commitments to everyone in the program who is selected to advance and to everyone selected to enter the program in July 1950.

**Q.** What has been the reaction of the residents who are to be taken out of the training program and sent overseas for 3 months this summer?

**A.** Information from all of the hospitals indicates that quotas for each of them were filled with volunteers. Each officer will re-enter the program when he returns and, if he qualifies, will stay until he completes his training. The Department of the Army General Staff and the staffs of overseas commands have considered this solution to

the medical problem of this summer a commendable one. We expect all of these young officers to have a professionally profitable service as well as an interesting trip.

Q. Can officers who transferred to the Air Force transfer back to the Army if they desire?

A. Yes. Transfers of personnel between the Army and Air Force were extended by Public Law 216, Eightieth Congress, for 1 year. This means that until 26 July 1950 transfers are legally authorized. Agreement between the Army and Air Force on each transfer is required. More than 100 transfers have been made since passage of the law.

Q. Are transfers between the Army and Navy so authorized?

A. No. If one desires to come into the Army from the Navy, or vice versa, it is necessary that he resign his commission and apply for a commission in the other service. There is a tacit understanding between all the services that resignation from a Reserve commission to accept a Regular commission in any of the services will be approved. The applicant should specify his preference of service.

Q. What is the status of the legislation to allow nurses over 35 years of age to enter the Regular Army if they have had several years of active duty?

A. This bill has been passed by the House of Representatives and it is expected that it will pass the Senate before adjournment. If passed as currently written, it will authorize a qualified nurse to enter the Regular Army if she entered on active duty prior to 16 April 1947 under the age of 35 years and either served continuously on active duty to the current date or was separated subsequent to 12 May 1945.

Q. What is the status of the legislation to allow women doctors, dentists, veterinarians, and allied medical specialists to be commissioned in the Army Medical Department?

A. This bill also has passed the House of Representatives and it is hoped that it will pass the Senate before adjournment this year. Difficulties in coordination of this bill have resulted from the fact that the Navy, while it had no objection to the Army and Air Force having this authority, did not desire to participate in its provisions. Oddly enough, the Navy, under the legislation act pertaining to the WAVE, may commission women doctors in the Navy and permit them to have some of the privileges of other medical officers. The Army cannot do this under the legislation pertaining to the WAC.

Q. Why are not the tours of duty in overseas stations the same for nurses of all three of the Armed Forces?

A. This question might be broadened to include all personnel. The Army, Navy, and Air Force each determine the length of stay in overseas station for their own personnel. For women components,

however, special conferences have been conducted in the Office of the Secretary of Defense to determine if it is feasible and desirable to set uniform tours that may vary from those of male officers and enlisted men; and it has been recommended that women in each of the departments should serve the same tours as the male personnel of their respective service.

Q. Is it possible for a medical officer to extend his tour of duty for 1 year in Europe?

A. There is a policy that an officer must serve for 1 year in the United States before being returned to an overseas station. Because of the general shortage of doctors and dentists, however, it is likely that exceptions could be made in their cases. Anyone desiring to extend his tour should write to the Office of the Surgeon General in order that exceptions may be requested and instructions can be given him.

Q. Why do promotion criteria often discriminate against an officer? For example, an officer might be in the zone of consideration for promotion if he were a Reserve officer on active duty rather than a Regular Army officer.

A. It is fully realized that such cases do occur each time a zone of consideration is announced. The officers most affected are those, who though highly deserving, were denied promotion during the war simply because of limitations imposed by Tables of Organization or Distribution. To comply with existing regulations, it is required that Regular Army officers be arranged on a roster in order of their permanent seniority and non-Regular officers in order of their temporary rank. Based on the estimated vacancies, the zone of consideration for each of these two rosters is established. The number of Reserve and Regular Army officers included in the zone of consideration must be in direct proportion to the total number of officers of each group. By requiring Regular Army officers to have a specific number of years for promotion purposes, plus a specified date of rank, the most senior officers, from the standpoint of permanent grade, are considered for promotion prior to their juniors. To extend a zone of consideration to include Regular Army officers who would meet the Reserve criteria would disrupt the Regular Army promotion sequence, thereby creating a situation that probably would be even less desirable than the present system. In the long run, probably fewer officers will be discriminated against by the rigid application of the present limitations. In other cases Reserve officers appear to be discriminated against. All cases of apparent inequity arise from the promotion policies extant during the war when centralized control was not maintained.

Q. What are the possibilities of Reserve Medical Service Corps officers remaining on active duty in the future?

A. All Medical Service Corps officers must decide before the termination of their present categories whether or not they will apply to accept the grade of master sergeant. The Pharmacy, Supply and Administrative Section in the Regular Army Medical Service Corps is filled and only a few are commissioned each year through the medium of competitive tours. There will be a need, however, for as many Reserve officers on active duty as Regular Army officers in this section for many years to come. Each officer should look critically at his own case and make up his mind about his future. Some will have a good chance of serving for many years and at the same time receive training that will be to their advantage when they return to civil life. Others should consider accepting the grade of master sergeant. Still others may have an opportunity of completing a career on officer status.

Q. What will be the future assignments for physical therapists, dietitians, and occupational therapists in the United States now that so many hospitals are to be closed?

A. With the closing of the hospitals it will be necessary that transfer of all but the most difficult of medical cases to the general hospitals be curtailed. The training program is beginning to produce physicians, nurses, and women specialists in such quantities that more complete medical care can be given in certain station hospitals. There are few Army hospitals of less than 250 beds left. There is every indication that Army medical practice in the future will be one of the most ideal group practices existing anywhere in the medical profession, wherein all components of the Medical Department will be represented in almost every station hospital.



## BOOK REVIEWS AND BOOKS RECEIVED



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HELP YOURSELF TO BETTER SIGHT, by Margaret Dirst Corbett. 218 pages. Prentice-Hall Inc., New York, N. Y., publishers, 1949. Price \$2.50.

This book, intended for lay persons, is a plug for the Bates method of treating refractive errors without glasses. Despite impressive testimonials this method is based on certain premises which, if not wholly unsound, are highly controversial. Chief among these is the idea that the eye may accommodate to near and distant vision through changes in the shape of the eyeball effected by the *extrinsic* ocular muscles. The advice to expose the eyes to direct sunlight ignores the evidence that such exposure predisposes to the formation of cataracts. Our orthodox ophthalmologists agree that the doctrine of relaxation, general and ocular, has much to commend it and that it may benefit selected patients, but the author in her enthusiasm gives no indication that there should be any selection of patients or that harm might result from the application of this method to some patients. In fact, claims are made that the methods employed have cured strabismus, astigmatism, presbyopia, subtotal blindness, and color-blindness with deafness thrown in for good measure. The pay-off occurs on page 186 where the highly esteemed Ishi Uarl charts are referred to as a clever bit of subversive work designed primarily not to detect color-blindness but to keep healthy American men out of our Armed Forces! The book has no Index.—*Lt. Col. W. G. Brandstadt, MC, U. S. A.*

AN INTRODUCTION TO ZEN BUDDHISM, by Daisetz Teitaro Suzuki, Ph. D., Professor of Buddhist Philosophy in the Otani University, Kyoto. Foreword by C. G. Jung, M. D., LL. D., D. Litt., D. Sc., 136 pages. The Philosophical Library, New York, N. Y., publishers, 1949. Price \$3.75.

Dr. Suzuki is the greatest living authority on Buddhist philosophy in general and Zen Buddhism in particular. Republication of this book, written in 1931, is part of a project to republish all his works, new and old, because none have been available since the war. Dr. C. G. Jung, in a 20-page foreword, paves the way by attempting to disabuse the Western mind of misconceptions. Suzuki

attacks the problem by showing first what Zen is not. He then attempts to present the positive side of the picture, but Westerners find Zen so difficult to grasp that other and more comprehensive works must be digested before an adequate understanding is reached—*Col W F Boowers, MC, U.S.A.*

**ALLERGY IN THEORY AND PRACTICE** by Robert A Cooke M.D., Sc.D. F.A.C.P. Attending Physician and Director of the Department of Allergy, the Roosevelt Hospital New York City in association with Horace S Baldwin, Robert Chobot, R. Clark Grove, Joseph Mackay, Selian Hebold, Michael Heidelberger, Paul Klempner, Louis Schwartz, W C Spain, Dudley D Stetson, Albert Vander Veer, Matthew Walker and Margaret B Strauss. 572 pages, Illustrated. W B Saunders Co, Philadelphia Pa., publishers, 1947. Price \$5

This book, written by one of the foremost practicing allergists in this country in conjunction with many associates, is an excellent textbook. The early chapters rapidly review the fundamental facts and experiments in immunology which form the basis for the present concepts of allergic mechanisms and clinical diseases. An earnest attempt is made to point out the gaps in our knowledge and to stimulate interest in further research.

The importance of a careful complete history in all allergic conditions is stressed, and there is an excellent section on skin testing, its techniques, interpretation of reactions, and limitations.

Each of the common allergic conditions is covered. The section on bronchial asthma is outstanding and that on allergic dermatitis very good. The presentation of the material in the chapters on allergic rhinitis could have been improved.

It is worth noting that this book very definitely emphasizes opinions of the authors and only occasionally is there mention of other points of view. However, for the young medical officer in the service without special training who is forced by circumstances to treat allergic patients, this volume can be recommended most highly—*Lt Col W H Dressner, MC, U.S.A.*

#### **THE STORY OF SCABIES Volume I**

Treatment of Scabies and its Relation to the Beginning of World War II  
of Dermatology and Syphilis

of the College of Physicians of Philadelphia Member of the Philadelphia Dermatological Society, American Academy of Dermatology and Syphilology, Society for Investigative Dermatology and American Association of the History of Medicine, Corresponding Member of the Italian Society of Dermatology and Syphilography and

American  
M. D.  
Medicine  
New York N Y

Dr Friedman, who is an international authority on the subject of scabies, has collected in volume I of a projected series of four volumes, material previously published in 1941 and 1942. Future volumes will be devoted to more recent advances in the study of Scabies Since World War II; The History of Scabies, and Classical Descriptions Relating to the Mite as Well as the Disease.

The reader never ceases to be amazed at the meticulous detail of Dr Friedman's study of a disease and its causative acarina. There are extensive excerpts of descriptions of the mite, the disease, and the treatment from the earliest medical records available relating thereto, with astute conclusions as to their accurate or inaccurate relationship to the subject.

Volume I of the series will appeal primarily to the medical historian and the student of entomology. The dermatologist will learn much of the history of his specialty by reading this work as scabies has held the limelight in dermatology until recent times.

The style makes pleasant reading, the illustrations are excellent but some of the tables are poorly produced.—*Lt. Col. V. R. Buschmann, MC, U. S. A.*

**THE PRACTICE OF REFRACTION**, by Sir Stewart Duke-Elder, K. C. V. O., M. A., D. Sc. (St. And.), Ph. D. (Lond.), M. D., F. R. C. S. Eng. D. S. C. (North-Western) Surgeon-Oculist to H. M. The King; Knight of Garter of the Order of St. John; Consulting Ophthalmic Surgeon to the Army and the Royal Air Force; Director of Research, Institute of Ophthalmology, University of London; Consulting Ophthalmic Surgeon, Moorfields Westminster and Central Eye Hospital; Ophthalmic Surgeon, St. George's Hospital. 5th edition. 317 pages with 216 illustrations. The C. V. Mosby Co., St. Louis, Mo., publishers, 1949. Price \$6.25

In his typical straightforward style, the author presents the basic principles of physiologic optics and of their interpretation in the human eye. He then discusses the common errors of refraction; the anomalies of refraction; eye muscle imbalance; and the various clinical examinations of the patient that should be performed in a complete refraction.

The final chapter, on the making and fitting of lenses, is well done, especially the concise appraisal of the present day status of contact lenses.

One of the deficiencies of this volume is the lack of a bibliography, which is so necessary in a book that covers most subjects in a rather matter-of-fact manner, when in reality much difference of opinion exists concerning many of the topics under discussion.—*Capt. A. J. Delaney, (MC) U. S. N.*

**KAYNE, PAGE, AND O'SHAUGHNESSY'S PULMONARY TUBERCULOSIS**, Pathology, Diagnosis, Management and Prevention, revised and partly rewritten by Walter Page, M. D., Pathologist, Central Middlesex County Hospital, London, F. A. H. Simmonds, M. A., M. D., D. P. H., Medical Director, Clare Hall County Hospital, Middlesex, S. MacDonal, M. B., M. R. C. P., Ed., Physician to the Chest Clinic, Redhill County Hospital, Middlesex; and L. Fatt, F. R. C. S., Thoracic Surgeon, Hillingdon County Hospital and Harefield County Hospital, Middlesex. 2d edition. 720 pages, illustrated. Geoffrey Cumberlege, Oxford University Press, New York, N. Y., publishers, 1948. Price \$18.50.

This comprehensive treatise reflects the opinions of the pathologist, medical man, and surgeon. It deals extensively with pathogenesis, diagnosis, and general management, and less with matters of prognosis and epidemiology. The exhaustiveness of the discussion and bibliography, the clinical and experimental pathology cited, the descriptions and illustrations of specialized techniques, place this book beyond the sphere of reference literature for the medical student, general practitioner, and surgeon.

The first part deals mainly with the pathogenesis of tuberculosis, both primary and "post-primary." The importance of the primary lesion in recurrence of active disease is stressed, as is the relation of pulmonary and extrapulmonary forms.

The various forms of pulmonary tuberculosis observed are well documented by case histories and reproductions of roentgenograms.

The following conditions are discussed in the differential diagnosis (and com-currence with tuberculosis): pneumonitis, bronchiectasis, chronic bronchitis, lung abscess, pneumococcosis, cancer, and sarcoidosis.

Under treatment, the value of streptomycin is assessed, collapse therapy is most extensively discussed, although the medical regimes in common use are not overlooked. Pathologic physiology is discussed in connection with cavities, unhepatized lesions, and atelectasis. Artificial pneumothorax, intrapleural pneumolysis, phrenicotomy, artificial pneumoperitoneum, and thoracoplasty are evaluated. Cavity drainage and extirpative measures are touched upon. The chapter on choice of procedures is of value.

From the public-health standpoint the measures for prevention and control include: segregation of active cases, pure milk supplies for children, BCG vac-

cination for children and adults who may be exposed to active cases, and periodic tuberculin testing and radiographic studies are discussed.

The appendices include the classifications used by the Ministry of Health in Great Britain, and the National Tuberculosis Association in the United States.—*Lt. (jg) P. W. Meier, Jr., (MC) U.S.N.*

**GERIATRIC MEDICINE.** *The Care of the Aging and the Aged.* Edited by Edward J. Sieglitz, M. S. M. D. F. A. C. P., Attending Internist, Suburban Hospital Bethesda, Md. (Chairman, Staff, 1945-47); Doctor's Hospital, Washington, D. C. Attending Internist (Geriatrics), Chestnut Lodge, Rockville, Md.; Consulting Internist, Washington Home for Incurables Associate, Washington School of Psychiatry Special Lecturer, Institute of Industrial Medicine, New York University Bellevue Postgraduate Medical School, New York City. Formerly Associate Clinical Professor of Medicine, Rush Medical College, The University of Chicago. 2d edition, 575 pages, illustrated. W. B. Saunders Co., Philadelphia, Pa., publishers, 1947. Price \$12.

In the second edition of this standard reference book, Dr. Sieglitz has presented the problems of caring for the aging and aged. He has added and integrated the talents of 46 distinguished collaborators, each an authority in his own field, thereby providing a more comprehensive discussion of the biology of aging.

The achievements of preventive medicine in controlling infectious diseases and the benefits of improved infant care have conferred a longer life expectancy upon our population. The problems of this "aging population" are dealt with in essay style, system by system, and disease by disease.

The belief that arteriosclerosis is a natural accomplishment of aging is no longer tenable in light of present knowledge. This problem is discussed clearly by Dr. Irving S. Wright.

Other diseases of stress and degeneration are considered with the suggestion implicit that preventive medicine might well prepare and redirect its energies toward problems in the field of geriatrics, long neglected and long considered to be irreversible and irreparable.

As with any medical work, there are unwritten chapters, for progress in the field of endocrinology has outstripped the pace of the printer. Other sources must be sought for a view of the forward moving scene involving ACTH, cortisone, the Selye hypothesis, and other pertinent correlations.

To all readers in search of an introduction to the very important medical problems incident to the care of the aging and the aged, this book is a rich storehouse of information, presented in a clear and concise manner.—Commander G. L. Calry, (MC) U. S. N.

**REFRACTION OF THE EYE,** by Alfred Cowan, M. D. Professor of Ophthalmology Graduate School of Medicine, University of Pennsylvania. Active Consulting Ophthalmologist, Philadelphia General Hospital. Consulting Ophthalmologist, Council for the Blind and Supervising Ophthalmologist of the Department of Public Assistance, Commonwealth of Pennsylvania. 3d edition, thoroughly revised, with 187 illustrations and 3 colored plates. Lea & Febiger, Philadelphia, Pa., publishers, 1948. Price \$5.50.

This work accomplishes the author's purpose in that it is "a book on clinical refraction employing the theory of ophthalmic optics in such a way that clinical aspects would emerge logically and in orderly sequence from their bases of scientific facts."

The illustrations are excellent, especially the three colored plates. All these help in the logical sequence of proof presented by the author for the laws of refraction and reflection.

The early chapters deal with light and its propagation; laws of reflection and laws of refraction, with mathematical proof for a pencil of light as it is affected by reflecting surfaces, prisms, thin and thick lenses of various forms—including

optical lenses, as well as the eye contents (cornea, aqueous, pupil formed by the iris, lens, vitreous, and retina). A recapitulation of laws of optics is presented summarizing each chapter. The chapter on ametropia is excellent in its presentation of theory, fact, and explanation. Methods of refraction are well explained, giving procedure and description of equipment necessary in performing the various phases of different methods, both objective and subjective. The prescribing of lenses for measuring visual acuity is delineated in logical steps with a discussion of the various special types of lenses, contact glasses, and telescopic spectacles.

A large bibliography with a complete index closes this well-prepared book. It will be a temporary closing only, for the student or ophthalmologist will find his memory refreshed with precisely illustrated facts. He will use it later as a reference for proof in refractions its affects the human eye.

This third edition of Cowan's *Refraction of the Eye* should replace older volumes, especially in our teaching centers because many concepts of clinical experts as well as scientific data have changed since the last edition. Present concepts as found herein are now used in teaching at the American Academy of Ophthalmology and Otolaryngology as well as in home study courses covering the field of ophthalmology. This newer knowledge is necessary in order to pass the American Board examinations.—*Capt. C. B. Johnson, (MC) U. S. N.*

**PEDIATRIC ANESTHESIA,** by M. Digby Leigh, M. D., Director of Anesthesia, Vancouver Hospital, Vancouver, Canada; Diplomate of the American Board of Anesthesiology. Formerly Director of Anesthesia, Children's Memorial Hospital, Montreal, Canada; Formerly Assistant Professor of Anesthesia, McGill University, Montreal, Canada; and M. Kathleen Belton, M. D., Supervisor of Pediatric Anesthesia, Vancouver General Hospital, Vancouver, Canada; Formerly Assistant Director of Anesthesia, Children's Memorial Hospital, Montreal, Canada; Formerly Demonstrator in Anesthesia, McGill University, Montreal, Canada. 210 pages, Illustrated. The Macmillan Co., New York, N. Y., publishers, 1948. Price \$5.50.

Doctors Leigh and Belton have drawn upon their extensive clinical experience to write a book which is well organized, easily read, and a "must" on the library list of every anesthesiologist.

It is only in the past few years that we have come to recognize and understand more fully the differences between adult and child physiology, differences which are of the utmost importance to the anesthetist. The greater metabolism of the child makes him less able to tolerate extremes of anesthesia or oxygen lack. The authors point out these differences and their significance so far as margin of safety is concerned, particularly in their discussion of respiration and circulation.

The proper psychological approach assumes greater significance when dealing with children, and the preoperative visit and medication are given considerable attention in this book. Optimal drug dosage for adequate premedication is presented.

All the various techniques of anesthesia are discussed, and there is a very comprehensive chapter on the choice of anesthetic agent and technique. Inhalation anesthesia is emphasized, particular reference being made to the use of Ayre's T tube and a valve which allows inflation of atmospheric air. Indications for intubation and the disadvantages of this technique are given. More might have been said about the use of curare in pediatric anesthesia.

Special chapters are devoted to complications, postoperative care, and oxygen and fluid therapy.

This book deserves unqualified recommendation because of its excellent coverage of a specific field within that of anesthesiology.—*Lt. (Jg) B. H. Pender (MC) U. S. N.*

DENTISTRY IN PUBLIC HEALTH edited by Walter J. Pelton, R. S. D. D. S., M. S. P. H., Dental Surgeon U. S. Public Health Service Colorado, and Jacob M. Wissner, D. D. S., M. S. P. H., Director, Joseph Samuels Dental Clinic, Rhode Island State Hospital for the Dental Health Section of the American Public Health Association. 367 pages, illustrated with 64 figures. The W. B. Saunders Co., Philadelphia, Pa. publishers, 1949. Price \$5.50.

Forces generated by the pressure of accumulated knowledge shape the course of events in all fields of endeavor. It is in response to such forces in the field of public health that Pelton and Wissner have contributed a most interesting and highly significant composite text.

This book constitutes a compilation of material derived from authoritative sources, all of which is relevant to dentistry's current status in the sphere of public health. It is composed of 17 chapters covering 352 pages, with 64 figures and is well indexed for ready reference. Each chapter has a comprehensive bibliography which may be used by readers to obtain detailed information with regard to the subject matter.

The introductory chapter by Louis S. Reed, Ph. D., sets the stage by the portrayal of sociologic trends and developments affecting all health services thus providing the necessary background by a description of the medical health plans which have been sponsored and/or adopted by medical groups and governmental agencies. Logical continuity then progresses to a consideration of "Dentistry in the Public Health Movement," a chapter presented by William R. Davis, D. D. S., Melvin L. Dollar, B. S., and Hugo Kulstad, D. D. S., deal with the "Economic Aspects of the Dental Health Problem" as related to dental needs and the cost and demand for dental care. Mathematical principles quantitatively applied to biologic materials, dental biometrics, constitute a masterful chapter written by Marguerite Hill, Ph. D. This material will have special appeal to research workers and dentists who are interested in a critical analysis of problems in the dental health field.

John W. Knutson, D. D. S., Dr. P. H., gives a clear word picture of the methodology involved in making statistical surveys and in evaluating various types of dental programs. Nina Simmonds, Sc. D., a prominent nutritionist, narrates the story of nutrition, beginning with a brief historical background which leads to the Present Concept of Food as a Factor in Dental Disease. Included in this narrative is a tabulation of 7 groups of foods suitable for checking the adequacy of patients' diets. Phillip Jay, D. D. S., M. S., Sc. D., depicts the modality of clinical laboratory tests for determination of caries activity.

Fluorine, scientifically considered from the viewpoints of early and recent research, is exceptionally well presented by two prominent investigators and writers in the field of public health, H. Trendley Dean, D. D. S., and Francis A. Arnold Jr., D. D. S. The former concerns himself with epidemiological characteristics of fluorosis, while the latter deals with fluorine in its systemic, oral environmental, experimental, and control aspects.

Philip Blackerby, Jr., D. D. S., M. S. P. H., reports the development, current status and trends of treatment in public health dentistry on the National, State, and local levels. The definition need, and methodology of dental health education is succinctly recounted by Dorothy B. Nylander, Ph. D.

A general review of administrative problems in dental health programs and the manner in which dentistry fits into the operation of health departments is sketched by Walter J. Pelton, D. D. S., M. S. P. H. This review of general considerations is supplemented and amplified by delineation of local dental health programs aptly described by Allen O. Gruelbel, D. D. S., M. S. P. H.; dental programs in urban communities by Harry Strasser, D. D. S., M. S. P. H.; and State dental programs by Frank C. Cady, D. D. S., M. S. P. H. A concluding chap-

ter by Harold Hillenbrand, D. D. S., briefly describes the principal dental professional Associations and Foundations.

America today is undoubtedly more sociologically inclined than at any previous time in its history. Transitory influences characteristic of postwar eras, capable of profoundly affecting the health of the Nation and the status of the health professions should be critically evaluated in the light of present knowledge. Members of the health professions should familiarize themselves with the contents of this book in order to have an intelligent concept of current influences in order to supply the leadership necessary to serve the best interests of their country and their profession.—*Capt. M. M. Maxwell, (DC) U. S. N.*

**RADIOLOGIC EXPLORATION OF THE BRONCHUS.** by S. di Blenzo, M. D., Assistant Professor of Radiology and Physiotherapy, Chief of the Radiology Department of the Institute of Cancer, The University of Córdoba, Argentina. Translated by Thomas A. Hughes, M. D., with a foreword by Richard H. Overholst, M. D. 332 pages. Illustrated. Charles C. Thomas, Springfield, Ill., publishers, 1949. Price \$10.75.

This book should be of value to the radiologist, physician, and surgeon, because it stresses the assistance of good bronchography in both the diagnosis and precise localization of pathologic lung changes. The fact that the book contains numerous typographical errors and that some of the terminology is strange to the North American student should not detract from its over-all value. In the discussion of both normal and pathologic conditions, the dynamics of the respiratory tree as revealed by the bronchographic procedure are continually emphasized. The book is profusely illustrated.

#### BOOKS RECEIVED

Receipt of the following books is acknowledged. As far as practicable, these will be reviewed at a later date.

**JORDAN-BURROWS TEXTBOOK OF BACTERIOLOGY.** by William Burrows, Ph. D., Professor of Bacteriology, Department of Bacteriology and Parasitology, the University of Chicago. With the collaboration of Francis Byron Gordon, Ph. D., M. D., Biological Department, Chemical Corps, Camp Detrick, Maryland; formerly Professor of Bacteriology, Department of Bacteriology and Parasitology, the University of Chicago; Richard Janvier Porter, Ph. D., Associate Professor of Parasitology, School of Public Health, the University of Michigan; and James William Shuldt, Ph. D., Assistant Professor of Biochemistry, Department of Bacteriology and Parasitology, the University of Chicago. 15th edition. 951 pages. Illustrated with 264 figures. W. B. Saunders Co., Philadelphia, Pa., publishers, 1949. Price \$9.

**THE VERTEBRATE BODY.** by Alfred Sherwood Romer, Alexander Agassiz Professor of Zoology, and Director, Museum of Comparative Zoology, Harvard University. 643 pages. Illustrated. W. B. Saunders Co., Philadelphia, Pa., publishers, 1949. Price \$5.50.

**HISTOPATHOLOGY OF THE SKIN.** by Walter F. Lever, M. D., Instructor in Dermatology, Harvard Medical School; Assistant Dermatologist, Massachusetts General Hospital, Associate in Dermatology, Peter Bent Brigham Hospital, Consulting Dermatologist, Massachusetts Eye and Ear Infirmary. 412 pages; 221 illustrations, including 8 subjects in color on 4 pages. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1949. Price \$10.

**PHARMACEUTICAL COMPOUNDING AND DISPENSING.** Editor in Chief Rufus A. Lyman, M. D., *Professor of Pharmacology, Tufts College; Technical Editor George Erlanger, *Professor of History of Pharmacy, Pennsylvania State University*, with 6 advisory editors and *Illustrated**. J. B. Lippincott Co.

**HUMAN PATHOLOGY.** by Howard T. Ransier, M. D., LL. D., former Professor of Pathology, Western Reserve University; Medical Research Advisor to the Bureau of Medicine and Surgery, United States Navy. 7th edition. 927 pages; 562 illustrations in

black and white and 22 subjects in color on 14 plates. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1949. Price \$12.

**THE DIASTOLIC OF PANCREATIC DISEASE** by Louis Rabinow M.D. formerly Assistant Professor of Clinical Medicine, Columbia University, and Assistant Visiting Physician to the Presbyterian Hospital, New York. With a foreword by Allen O. Whipple M.D. 74 pages. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1949. Price \$5.

**THE PHYSICIAN'S BUSINESS. Practical and Economic Aspects of Medicine** by George D. Wolf M.D., Assistant Clinical Professor, Otolaryngology, New York Medical College Fellow, New York Academy of Medicine Fellow, American Medical Association. Foreword by Harold Reines A.B., M.D. F.A.C.P. 3d edition 563 pages 96 illustrations. J. B. Lippincott Co., Philadelphia, Pa., publishers 1949. Price \$10.

**TRAUMA**, by Paul B. Magnuson M.D. F.A.C.S. Professor of Bone and Joint Surgery and Chairman of the Department, Northwestern University Medical School, Attending Surgeon, Pausonant Memorial Hospital and Wesley Memorial Hospital, Chicago, and James K. Stark A.B. M.D. F.A.C.S. Assistant Professor of Bone and Joint Surgery, Northwestern University Medical School, Attending Surgeon, Pausonant Memorial Hospital and Cook County Hospital Chicago. 5th edition 537 pages 223 illustrations. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1949. Price \$7.

**INORGANIC CHEMISTRY IN PHARMACY**, by Lloyd M. Parks, Ph.D., Professor of Pharmaceutical Chemistry, University of Wisconsin; Paul J. Jannke, Ph.D., Associate Professor of Pharmaceutical Chemistry, University of Connecticut, and Lord E. Harris, Ph.D. Professor of Pharmacy, Ohio State University, with a chapter on Isotopes by John E. Christian, Ph.D., Coordinator of Bio-Nucleonic Research School of Pharmacy, Purdue University. 295 pages. J. B. Lippincott Co., Philadelphia, Pa., publishers 1949. Price \$6.

# Tentative Program Session on Military Medicine and Surgery

## Section on Miscellaneous Topics American Medical Association Meetings

San Francisco, California  
28-29 June 1950

1. Military Medicine and Surgery as a Specialty  
Presented by: Rear Adm. J. T. Boone (MC) USN  
Discussed by: Dr. Howard Rank  
Dr. L. S. Radlin
2. Medical Problems Encountered in A-Bomb Explosions  
Presented by: Col. J. P. Conney, MC USA  
Discussed by: Dr. Eugene Pendergrass  
Dr. Shields Warren
3. Treatment of High Intensity Thermal Burns  
Presented by: Dr. Everett I. Evans  
Discussed by: Dr. James Barrett Brown  
Maj. Edwin J. Pulaski, MC, USA
4. The Treatment of Radiation Injuries  
Presented by: Dr. J. Garrett Allen  
Discussed by: Dr. Stafford Warren  
Lt. Comdr. E. P. Crookite (MC) USN
5. Stress as a Factor in the Production of Neuropsychiatric Diseases  
Presented by: Dr. Donald W. Hastings  
Discussed by: Dr. F. R. Hanson  
Dr. R. B. Boyd
6. Civilian Defense Planning  
Presented by: Dr. Norvin C. Kleefer  
Discussed by: Dr. James C. Sargent  
Dr. Robert H. Flinn
7. Medical Problems in Chemical Warfare  
Presented by: Col. John R. Wood, MC USA  
Discussed by: Dr. A. McElroy Harvey  
Dr. George M. Lyon
8. Medical Research and Development in the Armed Forces  
Presented by: Maj. Gen. G. E. Armstrong, MC, USA  
Discussed by: Dr. M. C. Wintermiz  
Dr. Lewis H. Weed
9. Medical Problems Encountered in Undersea Craft  
Presented by: Rear Adm. H. L. Purk (MC) USN  
Discussed by: Capt. O. D. Yarborough (MC) USN  
Capt. T. L. Whilmon (MC) USN
10. Communicable Diseases and Military Implications  
Presented by: Dr. Joseph E. Snider  
Discussed by: Dr. Norman Topping  
Dr. H. A. Heimann
11. The Effects of Air Transportation on Clinical Conditions. Analysis of 1000 Case Reports in IHP  
Presented by: Lt. Col. B. A. Strickland USAF (MC)  
Dr. J. A. Rafferty  
Discussed by: Brig. Gen. Wallace H. Graham, USAF (MC)  
Dr. W. Randolph Lovelace II
12. Military Medicine and its Relation to American Medicine  
Presented by: Dr. Richard L. Meling  
Discussed by: Maj. Gen. G. E. Armstrong, MC, USA  
Rear Adm. C. A. Swanson (MC) USN  
Maj. Gen. Harry G. Armstrong USAF (MC)

Five minutes will be allowed for the presentation of each subject.

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*Current List of Medical Literature*

(Army Medical Library) Weekly listings of  
journal contents by author, subject index  
monthly

*Quarterly Cumulative Index Medicus*

(American Medical Association) Author and  
subject.

*Index Catalogue of the Library of the Surgeon  
General's Office, U. S. Army*

(Army Medical Library) Now in Fourth Series  
Vol. X, Letter M (first half). Author and  
subject.

## Foreword

The UNITED STATES ARMED FORCES MEDICAL JOURNAL represents the unification of the BULLETIN OF THE UNITED STATES ARMY MEDICAL DEPARTMENT, published since 1922, and the UNITED STATES NAVAL MEDICAL BULLETIN, published since 1907. This joint periodical is the medium for disseminating information of administrative and professional interest to all medical personnel of the Department of Defense.

It is the aim to include in each issue administrative directives, original scientific and professional articles, editorial comments on current professional literature of special interest, clinical notes, descriptions of new devices and instruments, abstracts of articles from various medical periodicals, and notices and reviews of newly published professional books, of interest to all commissioned medical personnel of the Department of Defense.

The Director, Medical Services, and the Surgeons General of the several services extend an invitation to all medical officers, dental officers, Medical Service Corps officers, Nurse Corps officers, officers of the Veterinary Corps, all officers of the ancillary services of the medical services of the Armed Forces, and to the medical consultants of the Army, Navy, and Air Force to submit manuscripts for publication in this JOURNAL.

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*Any reference in an article of this publication to a proprietary drug or its chemical formula shall not constitute an endorsement of its效能 or use in the treatment of any disease*

UNITED STATES  
GOVERNMENT PRINTING OFFICE  
WASHINGTON : 1950

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Contributions are to be the original work of the author. Quotations must be accurately and carefully copied and full credit must be given to the source. References, tables (charts), and legends must be double-spaced and on separate sheets. Bibliography should be listed according to the Index Medicus, A.M.A. and the sequence should be as follows: name of the author and initials, title of article, name of periodical, volume number, pages, and month and year. Example: Hinton D., and Steiner, C. A.: Recurrent colic of sigmoid colon; unusual case report. Ann Surg 116: 147-149, July 1942. Authors are responsible for the accuracy of the bibliographical references.

The summary should be a factual and brief recapitulation of the observations or statements contained in the article. The conclusions drawn from the case, experiment, or facts set forth should be clearly stated and should appear at the close.

The editor is not responsible for the safe return of manuscripts and illustrations. All material supplied for illustration, if not original, must be accompanied by reference to the source and a statement that reproduction has been authorized. Recognizable photographs of patients should carry permission to publish.

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Address: U. S. Armed Forces Medical Journal, Bureau of Medicine and Surgery, Department of the Navy, Washington 25, D. C.

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*Lieutenant Colonel, Medical Corps,*

*United States Army.*

*ALFRED A. GENTILECORI, Associate Editor,*

*Captain, Medical Service Corps,*

*United States Air Force.*

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OFFICE OF THE SECRETARY OF DEFENSE  
WASHINGTON 25, D. C.

MEMO: Personnel of the Medical Services of the United States  
Armed Forces

A program of Whole Blood and Blood Derivatives for the Armed Forces has recently been completed. In the main, this program guarantees the Armed Forces an adequate blood program in the event of war. In general, it establishes a war reserve for plasma, plasma substitutes, supplies and equipment and recommends the equipment and procedures of the Armed Forces be used as standard for the various civilian agencies that may be requested to assist the Armed Forces in the event of national emergency.

Medical personnel of the Armed Forces can take pride in this program. It is the result of joint planning by representatives of the medical services of the three military departments on a Task Group in this office. As a result, this program not only aids the Armed Forces in their plans for national defense, but it is one of the first steps toward an over-all national blood program.

Sincerely,

*Richard L. Melling*  
Richard L. Melling, M.D.  
Director of Medical Services



# UNITED STATES ARMED FORCES MEDICAL JOURNAL

*Published monthly by the Department of Defense*

JOSEPH L. SCHWARTZ, *Captain (MC) U.S.N.*, Editor in Chief  
 WAYNE G. BRANDSTADT, *Lieutenant Colonel, MC, U.S.A.*, Associate Editor  
 ALFRED A. GENTILCORE, *U.S.A.F. (MSC)*, Associate Editor



THE PRINTING OF THIS PUBLICATION HAS BEEN APPROVED BY THE DIRECTOR OF THE BUREAU OF THE BUDGET, OCTOBER 19, 1949

## Survival in the Cold

CHAUNCEY G. BLY, *Captain, MC, A.U.S.<sup>1</sup>*

ROBERT E. JOHNSON, *M.D., Ph.D.<sup>1</sup>*

ROBERT M. KARR, *M.R.C.P., D.C.H.<sup>1</sup>*

C. FRANK CONNOLAZIO<sup>1</sup>

HAROLD L. SWAIN, *Master Sergeant, U.S.A.<sup>1</sup>*

ANGELO LAUDANI, *Captain, QMC, U.S.A.<sup>1</sup>*

MARY A. MALONEY, *B.S.<sup>1</sup>*

WILLIAM G. PIOTROWSKI, *Captain, MC, A.U.S.<sup>1</sup>*

LEON E. IMPERIALE, *Captain, MC, A.U.S.<sup>1</sup>*

**T**HIS study was designed to obtain information about a situation likely to face the Army whenever it becomes urgently necessary to transport troops into cold regions. Under such conditions, men acclimatized to warm weather in Southern training camps may be sent by air into Northern areas, usually without being indoctrinated and acclimatized to the cold. This happened during World War II, when men from desert training camps went directly to Attn. A special case must be met when troops transported by air are forced down in the North, where they will face the necessity of making sudden provision for survival. The present study simulated a survival situation for 32 heat-acclimatized men transported by air from MacDill Air Force Base, Fla., to bivouac at Camp Shilo, Manitoba, Canada, in the dead of winter.

<sup>1</sup>U.S. Army Medical Nutrition Laboratory, Chicago, Ill.

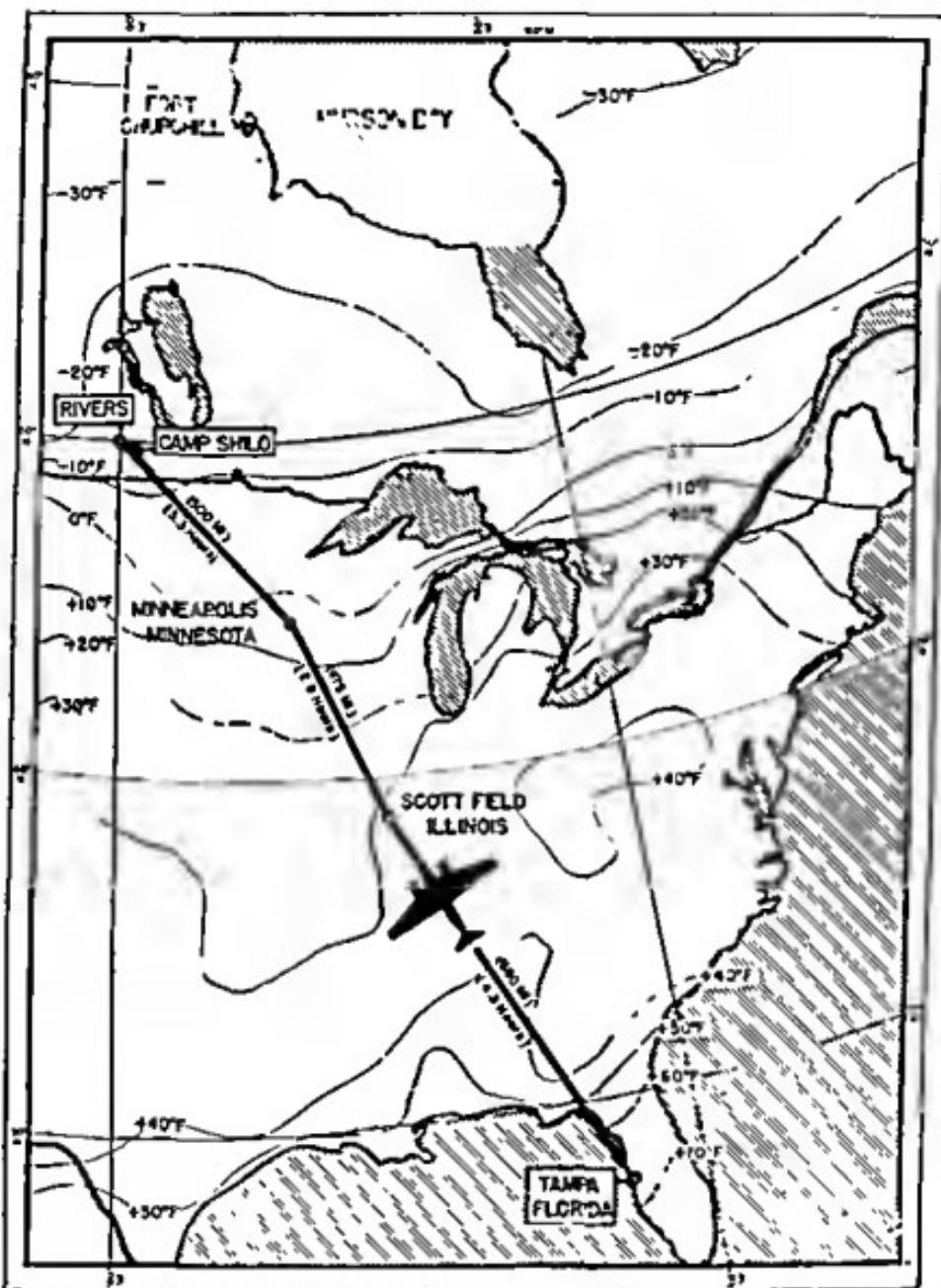


Figure 1.—Travel itinerary of test troops. The isotherms, derived from United States Weather Bureau data, are representative of the time of day at which the flight passed the given points.

Partial answers were sought to three general questions. First, what are some of the measurable metabolic changes in men during acute exposure to the cold, when the subjects are untrained and unacclimatized? Second, what are the dietary requirements for such men, performing only the minimal amount of physical work necessary to keep themselves comfortable in a cold bivouac area, and does the present experimental Air Force emergency ration meet these requirements? Specifically, under these conditions of acclimatization and activity, what are the requirements for water, calories, protein, inorganic salts, and vitamins? Third, can unifying explanations for the observations in these experiments be found in the literature on cold acclimatization, on heat acclimatization, on the "catabolic phase" after injury of any sort, on the adrenocorticotrophic hormone, or on the "adaptation syndrome" (1) (2) which is mediated by the pituitary-adrenal system when animals are subjected to severe stress? The reactions of the "adaptation syndrome" have been demonstrated in animals exposed to many types of stress, including cold, but as far as is known have not been studied in men exposed to the combined stresses of cold and inadequate rations.

In an attempt to answer these questions, a highly complicated experiment in which dietary, medical, biochemical, physiologic, and psychiatric observations were made on the subjects, first during a preliminary period in Florida, second during a simulated survival situation in the cold after the troops had been transported from Florida into Canada, and third during a period of recovery in heated barracks at Camp Shilo, Manitoba.

#### METHODS

Volunteer subjects from the 55th Reconnaissance Group at MacDill Air Force Base, Fla., were interviewed and examined, and 32 healthy young men were selected for the study. Few had ever experienced extremely cold weather, and many had never seen snow. After various observations had been made during a 2-week period, the men were issued pyramidal four-man Arctic tents with cloth floor and nylon liner, gasoline stoves (one- and two-burner), gasoline lanterns, mountain cook sets, and clothing (including U. S. Army Quartermaster winter issue of underwear, socks, woolen shirts, woolen trousers, sweaters, field caps with ear flaps, parkas, mittens with inner liners, windbreak trousers, and felt shoes) and were briefly acquainted with the use of this material.

On 29 January 1945, the troops and all their equipment were flown from MacDill Air Force Base, Fla., into Canada (fig. 1). During the 17-hour flight they were well protected against cold. During the two fuel stops they stayed in warm buildings. Two of the planes were poorly heated, but the troops were supplied with blankets and Arctic

## OUTDOOR WEATHER

FLORIDA

CANADA

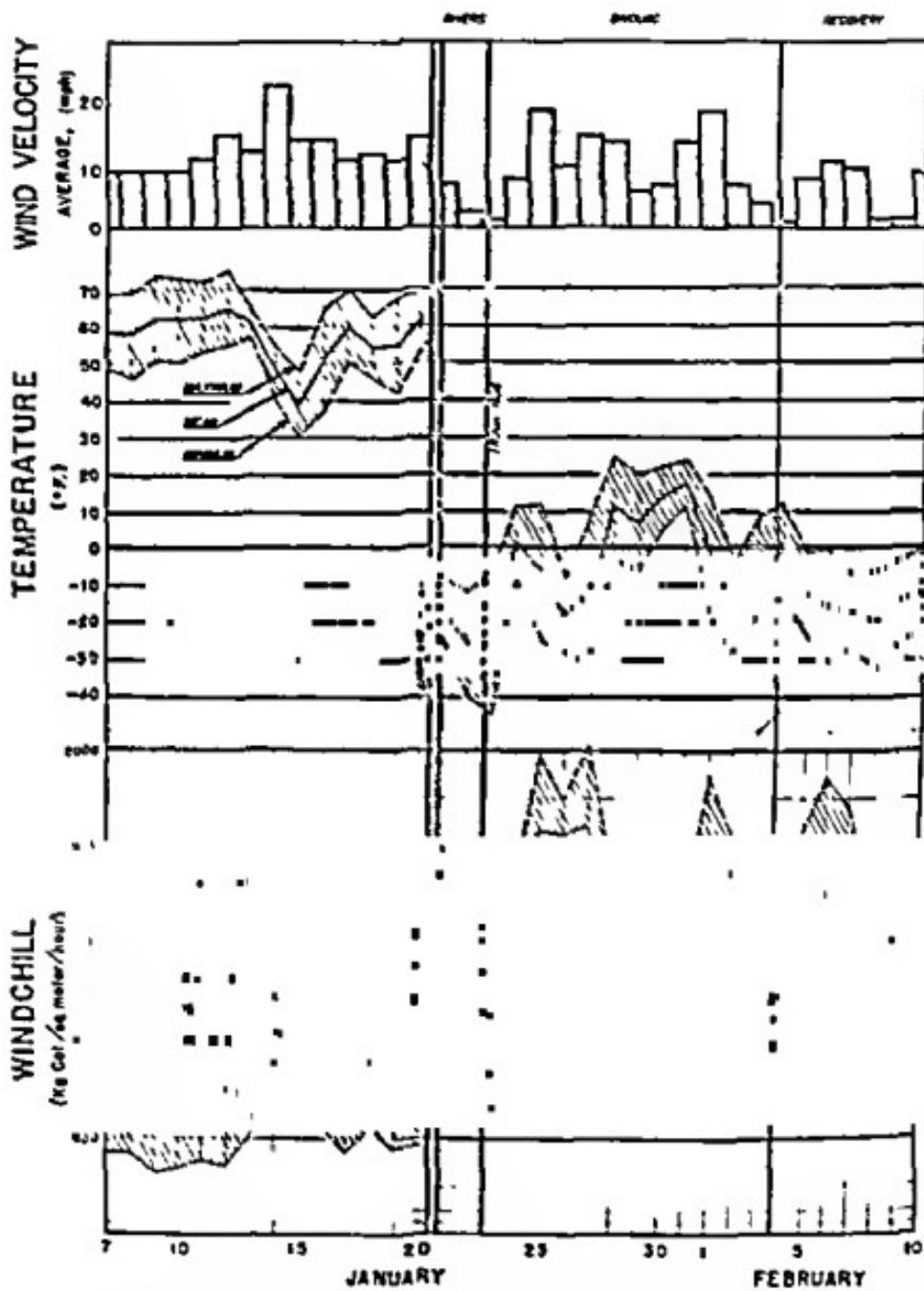


Figure 2.—Outdoor weather data in Florida and Canada in 1948. The windchill unit is one kilogram-calorie lost per square meter of exposed skin per hour based on the work of Siple (3).

## ACUTE EXPOSURE TO COLD-WATER BALANCE (AVERAGES FOR THIRTY SUBJECTS)

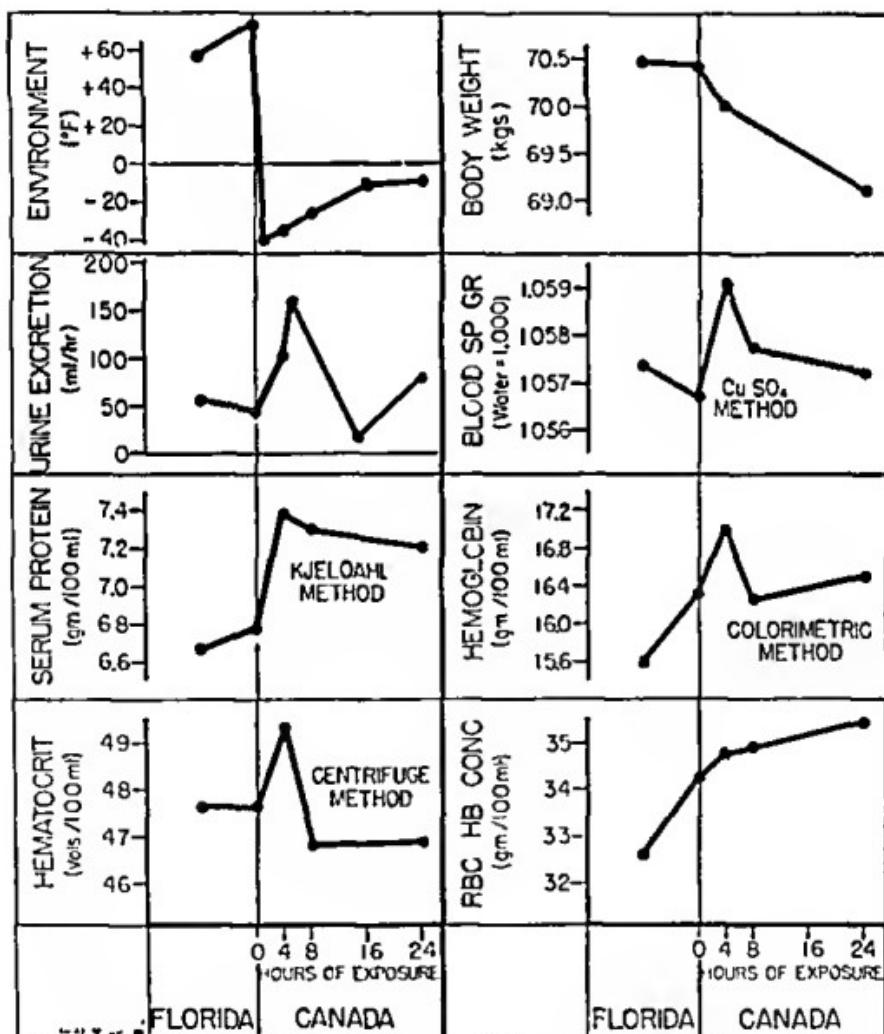


Figure 3.

clothing and there were only occasional mild complaints of cold. On arrival at Rivers Air Base, Manitoba, on 21 January, they were taken at once to well heated barracks kept at a mean temperature of 75° F. Except for minimal exposure to cold during transportation to and from heated mess halls, they were confined in these warm buildings for about 40 hours until the time for movement to their bivouac area near Camp Shilo, 45 miles away. It was assumed that any effects of the plane trip, such as chill and fatigue, were overcome by the restful stay in warm barracks. Subsequent studies of the pertinent data revealed no significant differences between the troops who had traveled in the heated plane and those in the unheated planes.

Early in the morning of 23 January, specimens of blood and urine were collected while the troops were still in the warm barracks. The troops were then transported without breakfast in open unheated canvas-covered trucks at a mean temperature of -35° F. to Camp Shilo, the trip of 45 miles taking 3 hours. At Camp Shilo, where an advance party of observers had made the necessary arrangements, further specimens of blood and urine were collected to detect alterations which had occurred during the 3-hour exposure to severe cold. At Camp Shilo, a specimen of blood was obtained and then the test subjects, still without breakfast, were issued rations and transported together with their tentage and duffel bags to the bivouac area, where they found ice for production of drinking water, and gasoline for cooking and heat. The bivouac region was chosen to assure isolation, desolation, and open exposure to the wind (fig. 2).

For the bivouac period, the 32 troops were segregated into 4 groups of 8 men. Each of the 4 groups was issued a different ration, as shown in table 1, and was restricted to a separate bivouac area, carefully isolated from civilization and from the other 3 bivouac areas, to prevent consumption of unauthorized foods and to prevent comparison of rations by the subjects of different groups. The 4 rations used in the bivouac period are described fully in the complete report.

TABLE 1.—Issue of rations to test troops

Period and group	Ration	Issued (rations per man per day)	Actual consumption (calories per man per day)
Florida All groups	U. S. Army 4 ration	1	3,000
Bivouac	Ration combat individual C-2	1	1,120
I	Ration emergency Air Force experimental	1	1,940
II	Packet food individual assault (experimental)	1	1,656
III	Ration small detachment 5-in-1	1½	4,820
IV			
Recovery <sup>1</sup>	Canadian Army ration scale No. 1	Unlimited	4,450
I	Canadian Army ration scale No. 1	1 unlimited	4,800
II	Canadian Army ration scale No. 1	1 unlimited	5,040
III	Canadian Army ration scale No. 1	1 unlimited	4,750
IV	Canadian Army ration scale No. 1	1 unlimited	

<sup>1</sup> Low calorie control group.

<sup>2</sup> High calorie (excess) control group.

\* Recovery caloric consumption was measured for 3½ days only.

The subjects lived in their respective areas for the next 12 days, except for short periods of from 1 to 4 hours each, when they were brought by truck to cold vacant barracks at Camp Shilo (fig. 3). In this building, an inside temperature as near to 50° F. as possible was maintained, the subjects stripped to their underclothing and with individually assigned blankets and mattresses, awaited their turns for various experimental procedures and observations. To secure continuous detailed observations, one medical officer lived in the bivouac tents with each group for the 12-day period.

As a psychologic stratagem to insure the continuity and reliability of the last days' observations, the subjects and staff were led to believe that they would be "rescued" on the fourteenth day at the earliest. They were suddenly rescued on the evening of the twelfth day, when they were quickly transported to a warm building in Camp Shilo where temperatures between 70° and 80° F. were maintained. They stayed there for the next 90 hours except for meal times, at which times exposure to cold in transit to warm mess halls was minimal.

This segregation of the troops in warm barracks made possible observations on initial changes following a period of dietary restriction and exposure to the cold. The men were allowed to eat as much of the Canadian ration scale No. 1 (comparable to U. S. Army field ration A) as desired, and were allowed to rest as much as desired. Physical activity was minimal, because the test troops had only to try to keep themselves comfortable. The daily calorie expenditure was calculated from time activity charts. It ranged from 3,600 calories per man per day in the high-calorie control group to 2,800 calories per man per day in the low-calorie control group, spontaneous voluntary activity in the bivouac area accounting for the differences.

The following observations were made once or more, and all data were subjected to statistical analysis:

(a) *Anthropometric observations*.—Body weight, height, surface area, waist circumference, and chest expansion.

(b) *Dietary history*.—Questionnaire on food preferences, quantitative consumption measurements, and quantitative chemical analysis of all food items used in the bivouac period.

(c) *Medical history*.—Incidence and intensity of symptoms.

(d) *Medical examination*.—Physical examination for signs of nutritional abnormalities; roentgenogram and electrocardiogram.

(e) *Psychiatric observations*.—Minnesota multiphasic personality inventory, personal interviews, self-appraisal questionnaire, diaries kept by test subjects, and observation by medical, military, and test personnel.

(f) *Functional observations*.—Physical fitness tests, gastrointestinal activity, skin and oral temperatures, renal-adrenocortical

# ACUTE EXPOSURE TO COLD—HEMATOLOGY

(AVERAGES FOR THIRTY SUBJECTS)

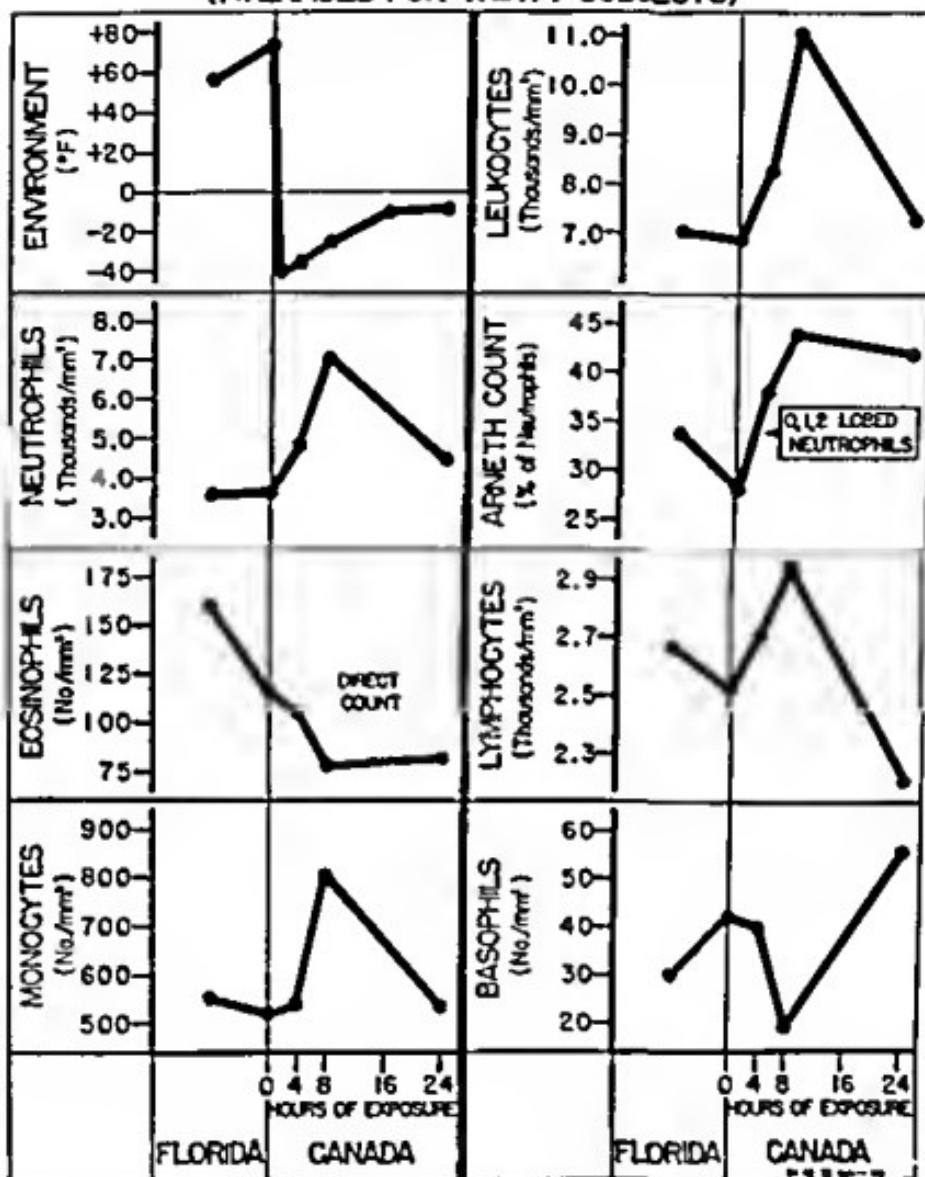
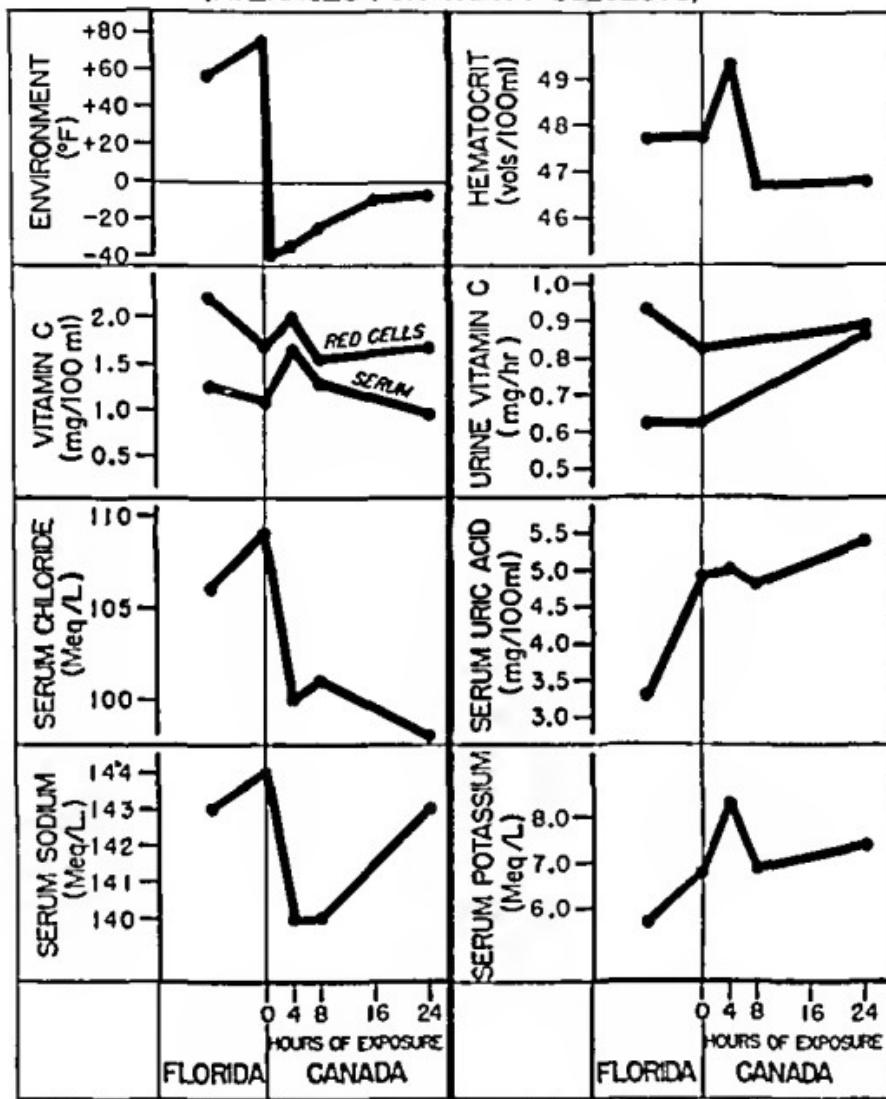


Figure 4.

# ACUTE EXPOSURE TO COLD—METABOLISM

(AVERAGES FOR THIRTY SUBJECTS)



*Figure 5.*

function tests by the water restriction-diuresis test, cardiovascular response to the cold pressor test, plasma and blood volumes, and qualitative examination of urine for acidity, acetone, sugar, albumin, and specific gravity.

(g) *Biochemical measurements*.—Whole blood: ascorbic acid; serum: chloride, inorganic phosphorus, sodium, potassium, ascorbic acid, uric acid, protein, urine: ascorbic acid, chloride, sodium, potassium, nitrogen, phosphorus, calcium, uric acid, creatinine, creatine; fecal: nitrogen, calcium, and phosphorus; and ration: ascorbic acid, nitrogen, calcium, phosphorus, sodium, potassium, and chloride.

(h) *Balance studies*.—All urine and feces were collected during the bivouac period. From analytical data on these, together with unanalytical data on the foods and fluids consumed, balances were computed for water, calories, nitrogen, sodium, potassium, phosphorus, calcium, and chloride.

(i) *Hematologic measurements*.—Red blood cell count, white blood cell count, differential count, hemoglobin, hematocrit, direct count of eosinophils, and Arnett's count.

(j) *Endocrines*.—Urinary excretion of 17-ketosteroids, gonadotropins, corticosteroids, androgens, and serum protein-bound iodine.

(k) *Acceptability, utility, and stability of rations*.—Direct observation by quartermaster and medical observers, qualitative data from questionnaires filled out by subjects, quantitative data from measurement of food consumption, and modification of items during storage, handling, freezing, and thawing.

#### REACTIONS TO COLD INDEPENDENT OF DIET

*Acute exposure (first 24 hours)*.—The statistically significant responses to acute exposure to the cold (i. e., differences between Florida and the first day of bivouac at a mean temperature of -26° F.) included (a) diuresis, with negative water balance, (b) hemoconcentration, with increases in concentration of serum protein, high hemoglobin, and high hematocrit readings; (c) reduction of eosinophils and lymphopenia (d) neutrophil leukocytosis, with increase in the percentage of immature forms; (e) hyperuricemia, hyperphosphatemia, and hyperpotassemia; (f) hyponatremia and hypochloremia; (g) transient retention of sodium and chloride, with transient increase of potassium in urine; (h) diminution of ascorbic acid in the blood, with an increase in the urine; and (i) transient hypothermia.

*Short term effects (first 12 days)*.—The significant subacute effects of cold independent of diet (i. e., the difference between Florida and the latter part of the 12-day bivouac period) included (a) change in kidney and adrenocortical function, a test dose of water being excreted rapidly and at a very low specific gravity; (b) eosinopenia and lymphopenia; (c) prolonged hyperuricemia and hyperphospha-

temia; and (d) bradycardia and decreased pulse pressure (figs. 4 and 5).

*Recovery after 12-day exposure.*—The significant changes in recovery independent of diet (i. e., differences between bivouac period and recovery period in warm barracks) included (a) large increase in body weight; (b) large positive water balance; (c) rise in eosinophil and lymphocyte count; (d) shift of neutrophils toward more mature forms; (e) diminution in serum uric acid and inorganic phosphate concentration; and (f) reversion of cardiovascular and of kidney and adrenocortical function toward Florida values.

*Conclusions regarding the immediate reactions to exposure to intense cold for 24 hours.*—On the basis of balance studies, there was no convincing evidence of a "catabolic phase" followed by an "anabolic phase," such as is seen after injury, although on the first day all groups excreted more nitrogen than on any other day of the bivouac period.

Many similarities were found between the present results and the effects of injecting ACTH (1). These similarities included hematologic changes (decrease of eosinophils, lymphopenia, neutrophil leukocytosis) and biochemical changes (increased serum uric acid, increased serum phosphate, retention of sodium and chloride, increase in the urinary urine acid/creatinine ratio), and the reversal of these changes when the cold stimulus was removed.

There were also many similarities between the present findings and those occurring in the general adaptation syndrome resulting from stress. During the first 24 hours there were changes similar to those occurring in the shock and countershock phases of the alarm reaction, i. e., hypothermia, diuresis and hemoconcentration, neutrophil leukocytosis, eosinopenia, lymphopenia, hyperuricemia, hyperphosphatemia, hyperpotassemia, hyponatremia, and hypochloremia. Most of these changes had reverted to preexposure values in 24 hours, except for the hematologic changes. The phase of resistance might be considered to be present in the last 10 days of exposure and the withdrawal of the cold stimulus, with many rebound phenomena, might be considered to represent the removal of the stress during the 7-day recovery period.

In the high-calorie control group, urinary excretion of 17-ketosteroids and nitrogen increased during the bivouac periods. In the three low calorie groups there were decreases. In all groups there was a diminution in the concentration of serum protein-bound iodine, and no consistent changes in urinary excretion of corticosteroids and androgens. These quantitative endocrine studies support the view that in well-fed men the pituitary-adrenocortical system is sharply stimulated during abrupt exposure to cold. In the present groups of subjects on low-calorie diets, some of the changes were either absent or in some way masked.

## REACTIONS OF THE TEST SUBJECTS AS RELATED TO DIET

The significant changes related to diet in the bivouac period (i.e., changes between the beginning and the end of the bivouac period) included (a) change in body weight in proportion to caloric balance; (b) nitrogen, phosphorus, calcium, sodium, potassium, and chloride balances in direct proportion to the intake of these substances; (c) voluntary fluid consumption related to the specific ration, with those

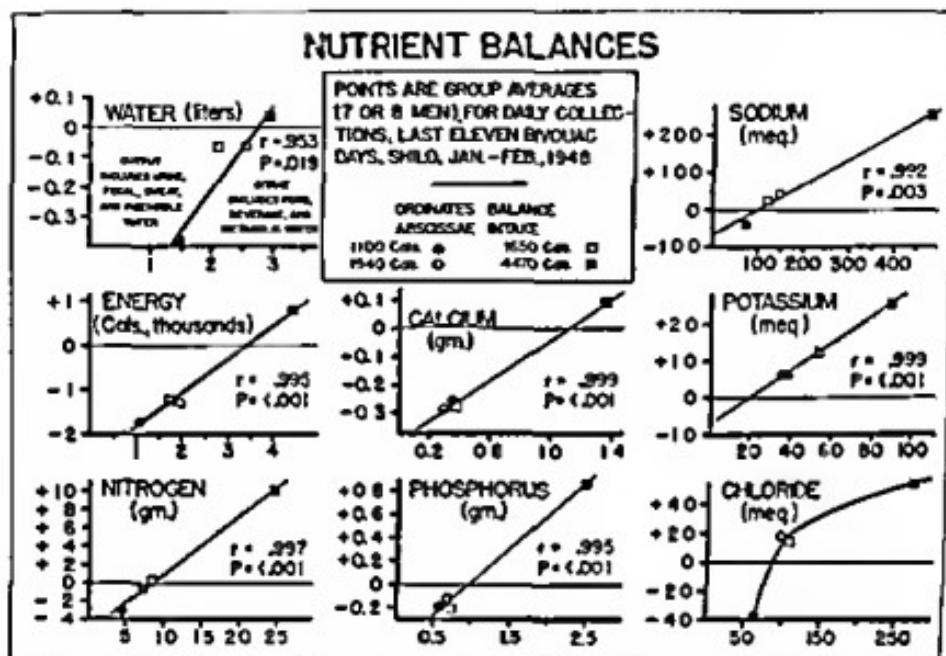


Figure 6.—Summary of nutrient balances.  $r$  = correlation coefficient between calculated line and observed data.  $P \times 100$  = chances in 100 that this correlation could have occurred by chance alone.

on the experimental Air Force emergency ration drinking almost a quart of water daily more than those on any other ration; (d) diminution in number of bowel movements directly proportional to caloric content of the ration; (e) increase in depressive symptoms in the three low-calorie groups compared to the high-calorie group as judged by the Minnesota multiphasic personality inventory; and (f) changes in the concentration of ascorbic acid in the blood and the excretion of ascorbic acid, related to the dietary intake of ascorbic acid, all being low in the group on the experimental Air Force emergency ration.

The following general conclusions are drawn concerning the rations, as they were used in a survival situation in the cold for 12 days:

(a) The only ration that sustained health, fitness, good psychologic attitude, and nutritional balance completely for 12 days was the 4,850 calorie 3-in-1 ration.

(b) The experimental Air Force emergency ration (1,940 calories) was in no way nutritionally superior to the 1,650-calorie experimental assault packet, and was greatly inferior in that it induced great thirst as proved by the consumption of fluids and was on the whole unpalatable. Its field utility was good.

(c) The low-calorie control ration (one-third of a C-2 ration) was equal to the other two low-calorie rations in every way except that negative nutrient balance was greater with it than with the other two. It was more palatable than the experimental Air Force emergency ration.

(d) When observed nutrient balances were plotted against actual nutrient intake, it was possible to calculate that nutrient intake at which exact balance could be maintained under the conditions of the present test (fig. 6). Such a calculation showed that for men with adequate clothing, fuel, and tentage, and doing no physical work other than that necessary to keep themselves comfortable, a balance could be obtained with palatable rations supplying, for an average 70-kilogram man, the nutrients shown in table 2.

TABLE 2.—*Nutrient intake necessary to maintain balance under conditions of present test*

Nutrient per man per day	Present test	Recommended daily allowance <sup>1</sup>
Calories	3,400	12,400-3,000
Water, including beverages, water in food items, and metabolic water	liters 2.8 grams 53	2.5 70
Protein, mostly animal	do 400	do
Carbohydrate	do 150	do
Fat	do 1.5	do
Potassium chloride	do 6.0	do
Sodium chloride	do 1.0	5-10
Phosphorus	do 1.2	do
Calcium	do 1.0	do
Vitamins	milligrams (1) do (1) do (1)	1.5 1.8 1.5
Thiamine	do 30-40	do
Riboflavin	do	do
Niacin	do	do
Ascorbic acid	do	do

<sup>1</sup> National Research Council

<sup>2</sup> Température équale, moderate activity

<sup>3</sup> Incomplete data

Conclusions from the present study should not be applied to any troops regularly required to perform more than moderate physical work. The evils of caloric deficiency among working troops should be so well known by now as to make this warning unnecessary, but experience in World War II showed that there is constant danger of inadequate caloric issue.

#### DISCUSSION

The implications of the present findings for further research on cold adaptation in man are clear. One phase of such continued study should be an assessment of the possibility of preacclimatizing men by treatment with ACTH. The known conferment of artificial ac-

climatization to heat by treatment with desoxycorticosterone acetate emphasizes the desirability of such studies in the cold. Another phase should cover further assessment of possible dietary and endocrinologic interrelations during adaptation to cold.

The implications of the present experiment for further ration development are also clear. There is good information on what American troops want and should have to eat, and in the present survival experiment, on what is required to keep inactive men in nutrient balance. Three lines of further research are indicated to answer the questions: (a) For troops in a survival situation, who have to protect themselves against the often hostile environment, extricate themselves, and guard against enemies, what are the safe limits of negative nutrient balance, both in duration and in degree of imbalance? (b) What importance should be attached to vitamins in a survival ration or, specifically, what is the vitamin C requirement in the cold? (c) What are the relative importances of fuel, water, and food in survival rations?

#### SUMMARY

During the course of a field test on the nutritional requirements of rations for survival in the cold, a comprehensive study was made on 32 volunteers flown directly from Florida to Canada in the dead of winter.

Complete metabolic balance studies were made for 12 days, during which time 4 groups of 8 men were segregated in separate survival areas and ate 1 of 4 different rations. Clear answers were obtained on the balance requirements for calories, water, protein, carbohydrate, fat, sodium, potassium, chloride, calcium, and phosphorus.

Frequent biochemical, physiologic and hematologic observations suggested that during the first 2 days of abrupt exposure to cold, unacclimatized soldiers exhibit a general adaptation syndrome, with stimulation of the pituitary-adrenocortical system.

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ACKNOWLEDGMENT—The assistance of The Prairie Command, Canadian Army, Winnipeg, Manitoba, Rivers Air Base, RCAF, Manitoba, and Camp Shilo, Manitoba is gratefully acknowledged.

# Fibrocystic Disease of Pancreas

## Review of the Literature and Report of a Case

CHARLES J. MOLNAR, JR., Lieutenant, junior grade (MC) U. S. N.<sup>3</sup>

IN 1888, Gee (1) of St. Bartholomew Hospital, London, described a symptom complex in children characterized clinically by early onset (1 to 5 years), irritability, loss of appetite, nausea, intolerance to fats and carbohydrates, large, frequent, fatty, foul-smelling stools, and varying degrees of malnutrition together with a protruding abdomen, stunting of growth, pallor, and weakness; this he called celiac disease.

However, during the past 11 years, the studies of Andersen and other investigators have shown that what has been known as celiac disease is composed of several distinct entities, each with its own clinical characteristics and laboratory findings. Of these, one of the most interesting is fibrocystic disease of the pancreas. This disorder, while presenting many manifestations in common with the celiac syndrome has certain distinguishing features which make its diagnosis more or less absolute.

Cystic fibrosis of the pancreas is a congenital and familial disease characterized clinically by an early onset, excellent appetite associated with poor weight gain, large, foul, fatty stools, and frequent respiratory infections with the development of chronic bronchitis and often bronchopneumonia and/or bronchiectasis terminally. The characteristic laboratory finding is the absence or considerable diminution of the secretion of pancreatic juice.

Because of the varied clinical findings and the disputed etiologic factors, classification of this disease is difficult. For practical purposes Farber (2) has proposed dividing the patients having this disease into three clinical groups: (a) those who died in the first few weeks of life, usually from meconium ileus; (b) those who died, usually in the first year of life, having had nutritional disturbances often associated with intercurrent respiratory disease; and (c) those who died of respiratory disease and who had preceliac or celiac symptoms. According to

<sup>3</sup>University of Pennsylvania Naval Research Officers' Training Corps, Philadelphia, Pa.

Farber (2), Andersen (3) and Zuelzer and Newton (4), the most common of these three groups is the second. The smallest number are in the third group, for death usually occurs before the celiac symptoms are clinically manifested. Zuelzer and Newton (4), in a study of 36 cases, reported that 14 percent of their patients died with meconium ileus in the newborn period; 67 percent of these patients had symptoms of initial upper respiratory infection; and 80 percent had respiratory symptoms before the age of 3 months.

The incidence of this disease is probably much greater than suspected. In 1938 Blackfan and May (5) reported that in 4 percent of 800 autopsies, pancreatic changes of some degree consistent with the diagnosis of cystic fibrosis of the pancreas was evident. Andersen (3) reported an incidence of 3.3 percent in her necropsy records during the same year.

Philipsborn, Lawrence, and Lewis (6) concluded from their study that there was no appreciable difference in the distribution between the sexes. However, Andersen (3) in her 1938 report of 49 cases, noted an incidence of 67 percent in female children.

Cystic fibrosis of the pancreas is predominantly a disease of infancy. The onset is usually during the first 6 months of life. In Philipsborn's (6) series of 26 patients, the oldest age at onset was 1 year. The remaining 23 were 5 months and under and the oldest was 4 years at death. Andersen (3) reported 1 child living to the age of 14½ years.

According to Zuelzer and Newton (4) cystic fibrosis of the pancreas is rare in Negroes.

From the review of 114 cases in which information as to siblings was given, Andersen (8) in 1946 drew the conclusion that "cystic fibrosis of the pancreas occurs among siblings, twins, and more distant relatives with a distribution which is compatible with the hypothesis that it is carried as a relatively infrequent hereditary trait."

Zuelzer and Newton (4) report a familial incidence of 7 in 21 families with histories that could be evaluated.

The etiologic factors and pathogenesis of fibrocystic disease of the pancreas is not clear. Norris and Tyson (7) have studied this disease anatomically, and concluded that the pathologic changes in the pancreas are congenital in that there is a characteristic distortion, cystic dilatation, and segmentation of the ducts. Simultaneously, replacement fibrosis takes place and does not interfere with the normal gross development of the pancreas. They compare the pancreatic lesion with polycystic changes in the kidney and liver.

Andersen and Hodges (8), on the other hand, believe that the lesion in the pancreas is not a malformation in the true sense of the word, but appears in the latter part of pregnancy. They believe that the pathologic change in the pancreas results from an abnormality of the

acinar secretion, and a comparable disturbance is found in the liver, gallbladder, intestines, and possibly in other glands. Baggeneoss (9) believes that the initiating congenital defect is in the inability of the patients to produce secretin in the duodenum which results in inspissation of pancreatic secretion. Farber (2) and Zuelzer and Newton (4) support the concept that this disease is a systemic affection characterized by the production of an abnormal secretion in a variety of glandular organs. It is their belief that the respiratory disturbance is an essential feature of the disease and is of the same pathogenesis. Andersen and Hodges (8) (10) however, attribute the respiratory changes to be secondary to a congenital defect. The lack of pancreatic secretion and consequent deficient digestion leads to a deficiency of a substance essential for the normal functioning of the bronchi. The fact that vitamin A is poorly absorbed by these patients, and that deficiency of vitamin A may lead to a change from ciliated to squamous epithelium in the bronchial mucosa, leads to the belief that vitamin A may be the essential substance. This concept is the basis for their treatment, which apparently gives good results (10).

The histopathology of the pancreas is uniformly described by most authors (2) (6) (11) (12) (14). Farber (2) describes the pancreas as follows: "The lesion in the pancreas seen most frequently is characterized by dilatation of ducts, inspissation of secretion, atrophy of acinar structures and replacement of connective tissue leading to marked fibrosis of the organ." Atresia or stenosis of the pancreatic ducts is not a constant finding. In the majority of cases, the obstruction appears in the acini. The islets of Langerhans are not involved, although the acinar pathologic change is progressive.

Significant lung pathologic changes usually occur during the first 6 months of life. Fundamentally the process in the lung is one of respiratory obstruction caused by tenacious mucus and secondary infection by *Staphylococcus aureus* (2) (6). The lungs in the majority of the patients contain bronchopneumonic areas and single or multiple abscesses. Emphysema, atelectasis, and bronchiectasis are common.

The liver may be enlarged (2) and show fatty changes (2) (6).

Distention of the acini and ducts of the salivary glands, with inspissated secretion as well as those of the mucous glands of the esophagus, duodenum, jejunum, and gallbladder are frequently noted.

Congenital obstruction of the gastrointestinal, genito-urinary, and biliary systems are found in association with fibrocystic disease of the pancreas.

Meconium ileus is the characteristic finding in the newborn. May and Lowe (12) believe that all infants suffering from meconium ileus or who exhibit unusual difficulty in passing meconium should be sus-

pected of fibrocystic disease of the pancreas. Other early findings are: a failure to gain weight despite good consumption of food; large, foul, fatty, frothy stools (common though not diagnostic); vomiting; diarrhea; and recurrent respiratory infections associated with a prominent cough that can be confused with whooping cough. The respiratory symptoms may overshadow the gastrointestinal picture. Should these patients survive the first 6 months, the celiac picture usually appears; i. e., retardation of growth, abdominal distention, emaciation, more frequent stools, and behavior disturbances. The respiratory infection becomes progressively more frequent and more severe.

Of the laboratory aids to diagnosis, the most important is the enzymatic analysis of the duodenal juice. The pancreatic enzymes, lipase, amylase, and trypsin are greatly reduced or absent. Andersen and Early (14) have described a technique for obtaining duodenal juice for analysis and stressed the importance of tryptic activity in the diagnosis. Secretin, according to Phillipsborn (6), may be given intravenously to stimulate the production of pancreatic juices. In fibrocystic disease, the enzymes, particularly trypsin, are decidedly reduced before and after stimulation. Aufanger and Heavensick (15) describe an amino acid tolerance test to aid in the diagnosis of this disease. The test depends upon the failure of digestion of protein as evidenced by the failure of the blood amino acid level to rise after the ingestion of gelatin. Andersen and Early (14) describe a laboratory procedure for determining trypsin activity.

Because of the poor fat absorption, the stools contain large amounts of fats, thus may contribute to the low blood cholesterol.

There is a great loss of nitrogen in the stool, far in excess of the urinary excretion of nitrogen, and this is responsible in part for the patient's poor nutritional state (15).

Vitamin A is poorly absorbed, and hence, low blood vitamin A curves may be of diagnostic value if done serially (6).

Glucose tolerance curves are usually flat, although they may show an initial sharp rise and a rapid fall as in hunger curves (15).

Attwood and Sargent (18) describe the lung findings as determined by roentgenographic study as follows:

There is an increase in the density of hilar shadows, with loss of definition and prolongation outward into a surrounding mottling that gradually diminishes toward the periphery of the lung. The changes are bilateral and are symmetrically distributed about the roots of the lungs and the adjacent parenchyma. The changes in the upper and lower lung fields are equally marked. Later in the disease, patchy areas of peribronchial infiltration and bronchiectasis are noted. The final stage is that of pneumonic infiltration, bronchiectasis and bronchietatic abscesses with varying degrees of atelectasis and obstructive emphysema.

Farber (15) directs therapy against the following four conditions which are directly or indirectly caused by pancreatic insufficiency: (a) absent or greatly reduced pancreatic enzyme activity, particularly trypsin and lipase; (b) malabsorption of vitamin A; (c) loss of nitrogen in the stools; and (d) upper respiratory obstruction and infection leading to bronchiectasis and bronchopneumonia.

Pancreatic substitution therapy is indicated for the pancreatic insufficiency. Farber (15) suggests pancreatic granules, 1 to 5 gm. daily in divided doses, sprinkled on the patient's food. May and Lowe (12) believe that the usefulness of pancreatic granules is questionable because the enzyme potency is low or uncertain and relatively little improvement is effected in absorption, and that they frequently decrease the appetite. Andersen, however, recommends the use of pancreatin, as does Philipsborn (6).

Farber (15) suggests 50,000 international units of vitamin A daily in divided doses supplemented by other vitamins. Prostigmine bromide may be given in doses of 3.75 to 7.50 mg. three times daily.

Farber (15), Andersen (10), and Di Sant'agnese and Andersen (16), recommend a high caloric diet and allow 30 to 50 percent greater caloric intake than that for calculated age, because of food loss in the stools. High protein, moderately low fat, and low starch diet is recommended. May and Lowe (12) (17) advise a well-balanced diet, adequate to satisfy the appetite. They believe there is little evidence supporting the nutritional theory in the cause of respiratory complications as advanced by Andersen, and that special diets are not warranted.

All authors agree that treatment with antibiotics is indicated for the concurrent respiratory infections. Di Sant'agnese and Andersen (16) suggest the use of sulfonamides prophylactically and in early respiratory infection but they are ineffective after the stage of suppurative bronchitis has begun. Penicillin may be effective in treatment of the respiratory tract after the appearance of respiratory distress and cyanosis, provided the organisms are sensitive. May and Lowe (12) (17) and Di Sant'agnese and Andersen (16) believe that the most effective way of administering penicillin is by aerosol and simultaneous intramuscular injection of the drug.

Late onset of the respiratory symptoms, good general development, and previous dietary regimen are to the patient's advantage.

#### CASE REPORT

M. A. L., a 5-year-old white girl, was admitted to the United States Naval Hospital, Philadelphia, Pa. She was cyanotic and had respiratory distress.

*Previous history*.—The patient was first seen in this clinic at the age of 2½ years because of frequent upper respiratory infections, large, foul-smelling, oily, mushy stools, and weight loss (Fig. 1).

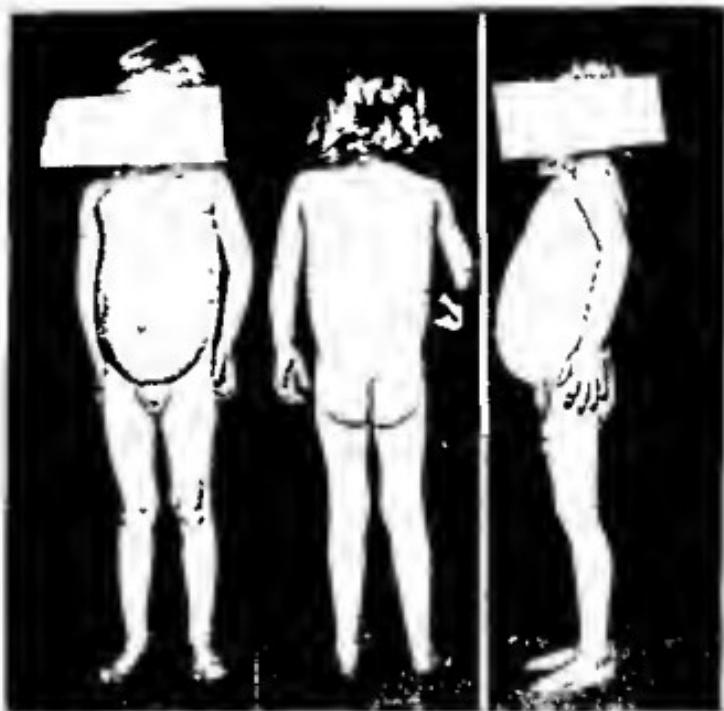


Figure 1—M. A. L. at age 2 years.

At birth she weighed 6 pounds 8 ounces, at 6 months, 11 pounds, at 1 year, 18 pounds, at 1½ years 22 pounds, and at 2½ years, 20 pounds. She was in good health until the age of 2 years, when a hacking and nonproductive cough began. Two months later her appetite began to fail and she showed a preference for protein food; she began to lose weight, and large, yellow, mushy stools, which previously had been brown and formed, were noted.

Physical examination at age 2½ years showed a chronically ill child. Fine crepitant rales were heard anteriorly and posteriorly in both lungs; there was no change on percussion. The heart was normal, abdomen protuberant; the vulvar fat was atrophied, liver and spleen were palpable just below the costal margin, and the buttocks and extremities showed evidence of wasting.

Tuberculin test (purified protein derivative No. 2) was negative at this time.

Laboratory examination of the stools revealed moderate amounts of neutral fat droplets, flakes, and fatty acids. Analysis of duodenal juice revealed: trypsin, 16 cc. (lowest normal figure is 10 cc.), no evidence of the presence of any trypsin; and amylase, 0.1 mg. (normal value for a child over 9 months is 20 cc. or more).

Chest roentgenograms showed accentuation of the bronchovascular markings bilaterally, and linear areas of increased density with diffuse nodular beading which extended out into the peripheral zones of the lung fields were radiating out from the hilar regions (fig 2). Roentgenograms of the long bones, heart, and abdomen were essentially negative.

With a history of chronic cough, frequent upper respiratory infection, loss of weight, large, foul, yellow, mushy stools, moderate amount of neutral fat droplets in the stool, absence of trypsin in duodenal juice, and pathologic lung changes as revealed by physical examination and roentgenograms, it was believed that the diagnosis of fibrocystic disease of the pancreas was established.

A high-protein, high-carbohydrate, and low-fat diet, vitamin D, and additional vitamin A, and pancreatic, 1 teaspoonful three times daily were prescribed.

She did well on this regimen. At the age of 3 years her appetite had improved, her coughing reduced, stools were brown and formed, and she had gained 3 pounds. However, her chest roentgenograms still showed peribronchial infiltration extending from the hilar trunks to the periphery.

Episodes of upper respiratory infections with fever continued; these responded to treatment until the present admission at the age of 5 years.

*Present history.*—Physical examination revealed an underweight, apprehensive, white child in acute distress. She was cyanotic, respirations were shallow and rapid, and her skin was pale and moist. Her temperature was 99.6° F., pulse rate, 142; respirations, 48. Eyes, ears, nose, throat, and heart were essentially normal. Loud moist râles were heard over the entire chest with respiratory wheezes. The abdomen was protuberant and there was early clubbing of fingers and 1+ pitting edema over the feet.



Figure 2.—Roentgenogram of the chest at age 2½ years.

Laboratory examination on admission revealed a moderate hypochromic microcytic anemia, normal white blood cell count and differential, and a trace of albumin and 1+ sugar in the urine.

She continued downhill in spite of vigorous therapy with intravenous fluids, whole blood, and penicillin. Death occurred 40 hours after admission, apparently from respiratory obstruction.

#### *Autopsy*

Autopsy showed the following:

##### *Gross examination*

The body was that of a white female child who appeared considerably younger than the stated age of 5 years. Height 38 inches, weight 30½ pounds. There was periorbital edema, abdominal distension, moderate atrophy of the gluteal muscle and a yellow purulent material in both nares.

*Pertitoneal cavity*—There was 500 cc. of clear yellow fluid and the colon was distended throughout.

*Pleural cavity*—A few thin fibrous adhesions were between the parietal and visceral pleura of both lungs.

*Mediastinum*—Mediastinal nodes were enlarged but showed no evidence of infiltration or necrosis. The trachea appeared to be completely filled with a yellow mucopurulent material.

*Lungs*—The external surface had a pale pink appearance and numerous deep purple areas were noted below the pleural surface. Upon palpation and sectioning these were found to be areas of consolidation. The ramifications of the bronchial tree appeared to be almost filled with a thick tenacious mucopurulent-yellow material. There was also a suggestion of segmental dilatation of the smaller bronchi.



Figure 3.—Microscopic view of pancreas.

*Liver and biliary passages*—Upon sectioning, the liver parenchyma had a pale brown appearance with a suggestion of whitish mottling which gave a nutmeg effect. The remainder appeared normal.

*Pancreas*—Palpation suggested a slight increase in fibrous consistency. On sectioning small fibrous areas were noted but cystic areas were encountered. Ducts appeared normal.

##### *Histologic examination*

*Respiratory*—Practically all of the alveoli showed microscopic consolidation either with closely packed polymorphonuclear leukocytes or masses of red cells which had the appearance of recent hemorrhage. In addition to these pneumonic features, the bronchioles were completely filled with solid plugs of polymorphonuclear leukocytes. In many areas the bronchiolar mucosa was absent. The surrounding adventitial tissue was greatly thickened with

fibrous tissue and a heavy infiltration of acute and chronic inflammatory cells. Some bronchioles appeared to be considerably dilated with thickened redundant mucosa. An abscess composed of polymorphonuclear leukocytes was encountered in one section.

**Liver.**—There was an extensive degree of fatty degeneration with only a rare intact parenchymal cell. The central area of the lobules was congested with red blood cells.

**Pancreas.**—In numerous sections, no pancreatic glandular tissue could be found. The glandular tissue was replaced by dense fibrous and collagenous connective tissue in which were embedded islands of duct structures lined with a columnar epithelium. Some of the larger ducts were dilated and contained an eosinophilic acellular material. Adjacent to these large structures, numerous small clusters of ducts were embedded in the fibrous tissue. Occasional clusters of lymphocytes were seen and compressed islets of Langerhans were noted (fig. 3).

Pathologic diagnosis confirmed the clinical diagnosis of fibrocystic disease of the pancreas with associated bronchiopneumonia, bronchiectasis, and pulmonary abscesses secondary to bronchiectasis.

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**THE SURGICAL MANAGEMENT OF PULMONARY COCCIDIOMYCOSIS IN FOCALIZED LESIONS.** by Sam J Greer, M D.; James H. Forsee, Colonel, MC, U. S. A.; and Hugh W. Malton, Colonel, MC, U. S. A. Journal of Thoracic Surgery 18: 591-604, Oct. 1949.

Coccidioidomycosis is endemic in Texas, New Mexico, Arizona and California. Patients who were trained in these regions and who contracted the disease while in the Armed Forces are now being discovered throughout the country. The disease exists in a primary respiratory form that is usually self limited and in a disseminated form that has a case fatality rate of about 50 percent. The authors report 13 patients having coccidioidal infections with focalized pulmonary lesions upon whom operations were performed. Nine had persistent cavitation for which lobectomy was performed, and four had rounded granulomatous lesions that were removed by wedge resection of the lung. The lesion was discovered on a routine roentgenogram of the chest in each case, although two of the patients gave a history of episodes of pleuritic pain on the side of the lesion and had had mild chronic productive coughs. The other two patients had been asymptomatic. The diagnosis was not established preoperatively in any of the four patients, although coccidioidomycosis was suspected in three. The nine patients with persistent cavitation were all symptomatic. They complained of a chronic cough that was productive except in one instance, but in no case was the cough severe, and none of the patients produced more than 1 cupful of sputum daily.

The diagnosis of chronic granulomatous lesions of coccidioidomycosis can seldom be made with certainty, and it is a sound policy to remove these tumors if only to establish a diagnosis and rule out the possibility of a more dangerous lesion. Even if the diagnosis is certain, operation removes the threat of cavitation or dissemination while the lesion is focalized. The problem of dealing with persistent cavitation is a different one. The cavities are usually near the periphery of the lung and may rupture, causing bronchopleural fistula, coccidioidal empyema, and nonexpansile lung. The authors believe that pulmonary resection should be reserved for patients having definite symptoms over a long period. Pulmonary resection is indicated in the few patients presenting incapacitating symptoms and evidence of chronic debilitating disease after prolonged hospitalization.—*Abstract*



# Prolapse of Redundant Gastric Mucosa

CURTIS P. ARTZ, *Captain, MC, U. S. A.*<sup>1</sup>

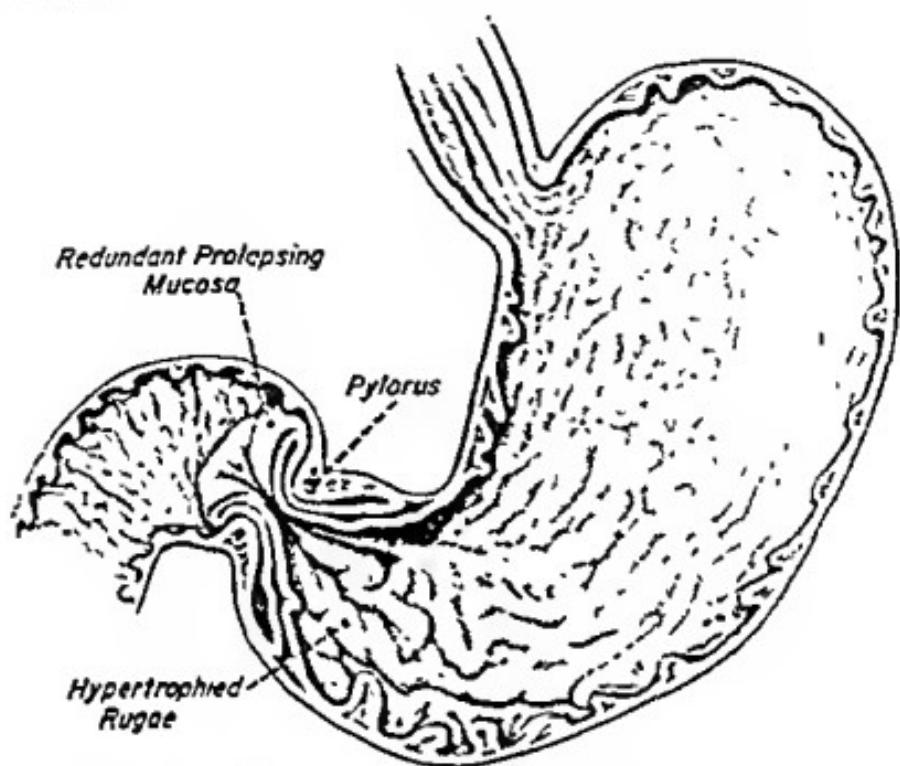
ROBERT T. GANTS, *Colonel, MC, U. S. A.*<sup>1</sup>

PROLAPSE of redundant hypertrophic gastric mucosal folds through the pyloric ring into the duodenum is now recognized as a distinct clinical phenomenon. It was first reported by Von Schmieden (1) in 1911. Melamed and Hiller (2) in 1943 found 19 cases reported and added 1 of their own. Since then about 100 additional cases have been described (3) (4) (5) (6) (7) (8) (9) (10) (11). There is great variance in the clinical significance attached to the condition by different authors. Some feel that the roentgenologic appearance of a prolapse usually has no significance and so do not report it (12). Manning and Highsmith (7) believe that it is one of the clinical findings of hypertrophic gastritis and that it will respond well to the medical regimen used for peptic ulcer. Van Nostrand, Arnold, and Palmer (8) stress the importance of this diagnosis as an explanation for otherwise undiagnosed upper gastrointestinal symptoms. Others feel that the condition is a surgical entity requiring partial gastric resection or removal of the redundant mucosa and pyloroplasty (5) (13) (14). It would appear that this condition is being diagnosed at various stages corresponding to various degrees of prolapse and that the symptoms vary accordingly. Clinicians and roentgenologists should become cognizant of this entity and always include it in the differential diagnosis of upper gastrointestinal disease. Diagnoses will become more frequent as additional attention is directed to the disorder. The condition is shown schematically in figure 1.

## INCIDENCE

The reported incidence of the disease varies widely. Scott (3) found in his series of 1,346 examinations of young men that prolapse of the gastric mucosa occurred as often as gastric ulcer. The wide variance of the incidence figures in table 1 may be caused by the severity of the prolapse in the cases reported. Rees (15) reports that three of his

<sup>1</sup> Station Hospital, Fort Bragg, N. C.



*Figure 1.—The hypertrophied mucosa of the antrum elongates and prolapses through the pylorus.*

six cases were so severe that operation was required. Only three cases in Scott's group were operated on but 9 of the 14 have roentgenographic evidence of moderately large prolapses. In the larger series of 23 reported by Ferguson, only 4 were sufficiently extensive to warrant operation.

TABLE I.—Incidence of prolapsed gastric viscera

Author	Clinic	Roentgenologic examinations of upper gastrointestinal tract	Prolapsed mucosa	Incidence (percent)
Rees	San Diego County Hospital and Rees-Schles Clinic	8,550	6	0.19
Scott	U. S. Navy	1,316	14	1.04
Ferguson	Grady Memorial Hospital and Emory University Hospital	27	23	7
Van Nostrand et al. Cove and Curphey	Walter Reed General Hospital Curphey Clinic Stockton Calif.	940 650	10 22	1.04 3.35
Total	-	9,443	73	0.77

#### ETIOLOGY

The causative factors and sequence of events leading to redundancy and prolapse of the gastric mucosa have not been definitely established. The theories fall into three general classifications.

1. *Irritation, hypertrophy, and mechanical prolapse.*—Eliason and Wright (16) suggest that chronic irritation (either physical, nutritional, functional, chemical, or bacterial) produces a low-grade inflammation of the antral mucosa. This promotes the production of hypertrophied folds which enlarge and elongate through the pyloric ring on mechanical stimulation from hyperactive peristaltic waves. Bralow and Spellberg (17) believe that the irritation is a benign peptic ulceration located at the base of the duodenal bulb or in the prepyloric area. This ulceration is followed by gastritis, healing, and the production of hypertrophic mucosal folds which herniate with increased peristaltic activity.

2. *Narrowing of the pylorus, hyperperistalsis, loosened mucosa, and prolapse.*—Rees (15) has observed a narrowing of the pyloric lumen which he believes precedes mucosal change. The decrease in the size of the pyloric outlet stimulates hyperperistalsis. The hyperactivity of the peristaltic waves pushing stomach contents against a constricted orifice loosens the mucous membrane on the muscularis with resultant trauma, hypertrophy, and prolapse.

3. *Neurogenic stimulation, abnormal peristalsis, and forced prolapse.*—Scott (3) feels that the necessary structural conditions are inherent in the normal stomach and prolapse occurs only after the fibers in the flexible submucosa have been stretched and loosened by abnormal gastric peristalsis. This increased motility may be initiated by neurogenic or chemical stimuli produced by worry, excitement, irregular daily schedules, or excessive use of coffee, tobacco, or alcohol. He believes that such psychosomatic stimulation contributes more to prolapse than does preexisting disease of the gastric mucosa or of the pylorus.

#### PATHOLOGY

The pathologic changes involved are essentially a redundancy and increased mobility of the antral mucosa with varying degrees of hypertrophy and chronic inflammation. Rees (15) reports a narrowing of the pylorus with a fibrous degeneration of the muscular tissue. At times strangulation may cause the mucosal folds to become irritated and edematous, with superficial erosion and ulceration resulting in hemorrhage. Microscopically, the resected mucosal folds usually show some evidence of chronic gastritis with congestion of the vascular channels and lymphocytic infiltration of the lamina propria.

#### SYMPTOMS

Patients with this disorder do not present a characteristic group of complaints. This is to be expected in view of the wide variance in the extent of the prolapsed mucosa. Although pain, epigastric distress, fullness, nausea, and vomiting are imminent during the stage in which an elongated fold is forcibly herniated into the duodenum,

when the mucosa returns to the stomach only minimal discomfort is present. If the degree of prolapse is small, only a minor degree of obstruction and pyloric spasm exists and the complaints are less severe. Intermittent upper abdominal discomfort either aching or cramp-like in character is the most consistent symptom. This may or may not be relieved by the ingestion of food. If appreciable obstruction is present, the distress with concomitant vomiting, occurs after eating. Scott (3) noted that epigastric distress in 10 of his 14 patients was relieved by food but not by alkalies. He believed that superficial ulcerations and vigorous gastric peristalsis that responded to the ingestion of bland foods were present. Secondary anemia caused by ulceration and oozing has been emphasized by Pendergrass (18). Usually asymptomatic periods and temporary improvement follow the use of antispasmodics and a bland diet. This is explained on the basis of intermittent herniation, with edema and mucosal irritation followed by reduction and the return of the prolapsed folds to a normal or nearly normal state. In every atypical ulcer history variability and intermittency of the symptoms should provoke suspicion of prolapsed gastric mucosa.

#### SEVERE GASTRIC HEMORRHAGE

The case report presented in this discussion emphasizes the importance of prolapsed mucosa in the etiology of severe upper gastrointestinal hemorrhage. In reviewing about 100 cases of prolapse now reported in the literature, it was found that 12 were complicated by severe hematemesis and melena. This is more than twice the generally accepted incidence (5 percent) associated with duodenal ulcers. Although the frequency of prolapse is not great, this condition may be the cause of many severe undiagnosed gastrointestinal hemorrhages.

#### DIAGNOSIS

Roentgenographic examination is required to establish a definite diagnosis. A central umbrella-like negative shadow appearing as a filling defect at the base of the duodenal bulb is typical. Inasmuch as the stage and degree of prolapse may vary at different times as well as at various periods of development, repeated roentgenographic examinations may be required to establish a definite diagnosis. If examination is performed in a quiescent period the mucosal folds may not prolapse through the pyloric ring to present the typical deformity. Multiple examinations preferably during an exacerbation of symptoms is recommended.

Scott has outlined the following important points of roentgenologic examination: (a) The filling defects in the duodenal bulb are invariably in the base, immediately around the pyloric opening; (b)

the redundant folds produce a lobulated mushroomlike negative shadow; (c) the filling defects vary in size and appearance in a single examination or on repeated examination because of the changes in the degree of prolapse, in contradistinction to the findings associated with duodenal ulcers which are constant during any one examination; (d) the redundant gastric rugae can be traced from the antral canal through the pylorus to the base of the bulb; (e) the duodenal bulb is not irritable with prolapsed mucosa, in contradistinction to the findings associated with an active ulcer; (f) gastric peristalsis is more vigorous than normal; (g) fluoroscopy must be supplemented by serial "spot films" or prolapse may be overlooked; and (h) although some authors (19) advise examination in the prone position, the prolapsed folds can be demonstrated with the patient erect. Pedunculated prolapsed gastric polypi are most often confused with prolapsed mucosa. Differential diagnosis must also include duodenal ulcer, papilloma of the duodenum, hypertrophic types of gastritis, and adult hypertrophy of the pyloric muscle.

#### TREATMENT

*Medical.*—The management of the patient with a mucosal prolapse depends on the extent of the lesion and the severity of the symptoms. In slight or moderate prolapse a thorough trial on a medical regimen is indicated. A bland diet of the ulcer-recovery type, antispasmodics, mild sedation, rest, relaxation, and freedom from tension may result in improvement. Unless such a complication as hemorrhage or obstruction is present, every patient should receive an adequate trial on medical therapy before surgery is considered.

*Surgical.*—The indications for surgery are:

(a) Obstruction: The more extensive prolapses usually show clinical or roentgenologic evidence of pyloric obstruction. Although gastric decompression and the administration of antispasmodics may afford temporary relief, surgery will eventually be necessary.

(b) Hemorrhage: Major hemorrhage or continued oozing giving rise to severe anemia warrants surgery.

(c) Persistent symptoms after adequate medical therapy: The majority of the cases will fall in this group. If the lesion is diagnosed early before the prolapse has progressed, medical management may suffice for some time but with further development of the herniation, persistent epigastric pain and distress will result and surgery will be required. Once the diagnosis is established, all uncomplicated cases should be given an adequate trial on medical therapy before surgery is considered.

(d) Equivocal roentgenographic findings: The most difficult lesions to differentiate from prolapsed mucosa are the prolapsed peduncu-

lated gastric tumors or polyps. Whenever there is doubt about the presence of a pedunculated tumor, surgical exploration is required to rule out malignancy.

Several types of operation, including gastrojejunostomy, partial gastrectomy, pyloroplasty, and simple excision of the redundant mucosa have been tried. Rees (15) suggests gastrotomy, excision of the redundant mucosal folds, anchorage of the mucosa to the underlying muscularis, and pyloromyotomy. More recent opinions favor simple removal of the excess mucosa followed by a Heineke-Mikulicz or a Finney type of pyloroplasty (3) (4) (5). The case reported in this article was satisfactorily treated by a longitudinal incision of the anterior pylorus, excision of the redundant folds followed by hemostatic suturing of the mucosa, and transverse closure of the pyloric incision.

#### CASE REPORT

A 31 year-old sergeant had a gross gastric hemorrhage on 4 October 1946. After immediate admission to an Army general hospital, four subsequent bouts of hematemesis ensued which caused unconsciousness for 3 days. After repeated transfusions he was given a bland diet, aluminum hydroxide, belladonna, and phenobarbital for the remainder of his 7-month period of convalescence in the hospital. In this period repeated roentgenologic examinations of the entire gastrointestinal tract and gastroscopy revealed no abnormality. While on the above medical regimen, he had no hematemesis, anorexia, or vomiting but noted some vague epigastric distress. Medical therapy was continued until October 1947. In February 1948 he began to vomit and to have a feeling of fullness in the upper abdomen. A wave of nausea followed by immediate vomiting would appear suddenly, 1 or 2 hours after meals, with no untoward reaction thereafter. These attacks occurred as often as once a day. Repeated roentgenologic examinations of the upper gastrointestinal tract again revealed nothing abnormal. He returned to a medical ulcer regimen with intermittent relief for 6 months. The symptoms then became more persistent and on 16 August he was admitted to this hospital.

Roentgenographic examination revealed a mushroomlike deformity at the base of the duodenum with irregularity of the mucosal contour of the pylorus (fig. 2). There was no anemia or loss of weight. The 12-hour nocturnal gastric secretion was 800 cc. The free acidity was 36 mi., and the total acidity was 54 mi. His alcohol and tobacco consumption had always been minimal. There was a 6-year history of idiopathic difficulty and moderate evidence of nervous instability. Previous severe gastric hemorrhage, and failure of 18 months of medical therapy, were indications for operation. On 24 September, through a transverse abdominal incision the anterior pylorus was opened longitudinally. A 2-cm fold of gastric mucosa extended around the circumference of the pyloric outlet and passed into the duodenum. There was no edema of the mucosa or fibrous thickening of the pyloric musculature. The redundant fold was excised and the mucosa sutured to the underlying muscularis for hemostasis. The longitudinal opening was closed transversely as a classical Heineke-Mikulicz pyloroplasty. The patient was ambulatory the day after the operation and on the tenth postoperative day was discharged on an ulcer-recovery diet. Later roentgenographic examination showed no evidence of further prolapse. When last seen in March 1949 he was symptom-free.

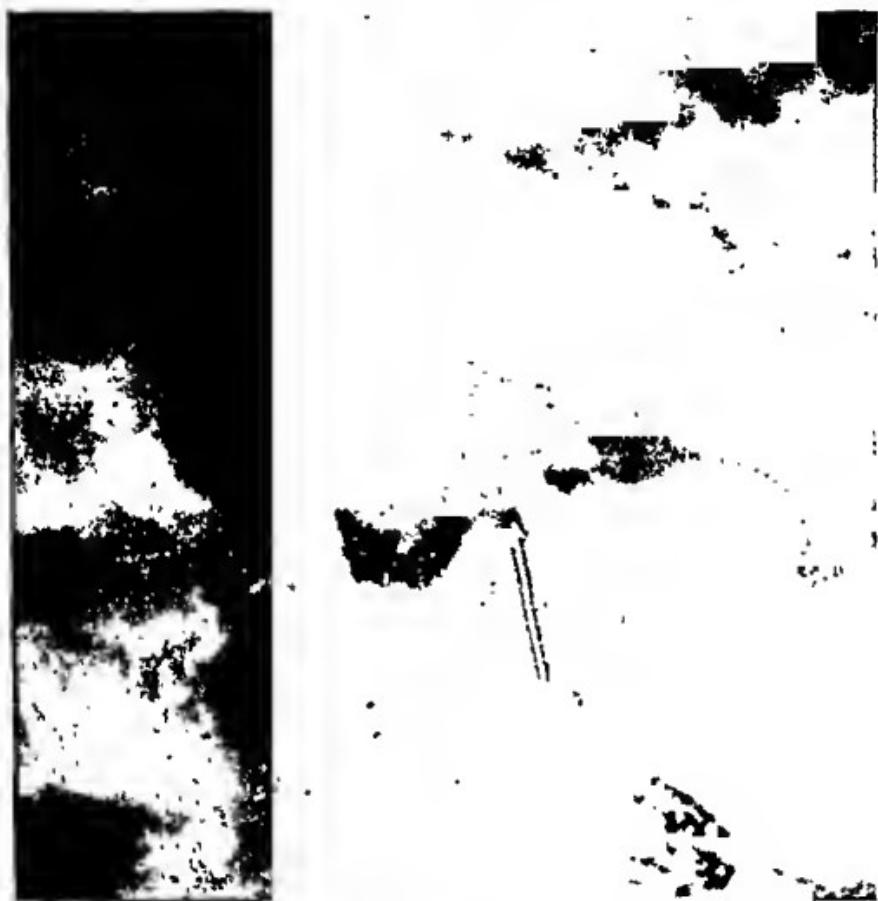


Figure 2.—Roentgenogram of upper gastrointestinal tract. Arrow indicates the characteristic umbrella-like dark shadow at the base of the duodenum.

Pathologic examination of the resected mucosa revealed a small amount of hemorrhagic exudate on the surface. The epithelium was intact and the mucus-secreting cells in the deeper portion appeared somewhat distended. The lamina propria exhibited some lymphocytic infiltration and engorgement of the smaller vascular channels. These findings are compatible with chronic gastritis.

#### SUMMARY

An increasing number of cases of prolapsed gastric mucosa are being reported. Additional emphasis in the literature brings this entity to the attention of more physicians with a resultant increase in the frequency of diagnosis. The etiologic factor is still obscure. The predominant change is a redundancy and mobility of the gastric mucosa with some degree of hypertrophy and chronic inflammation. The symptoms vary with the severity of the disease. Intermittent epigastric distress and vomiting predominate. Severe hemorrhage occurs in about 12 percent of the cases. Prolapsed mucosa may be

the cause of many presently undiagnosed hemorrhages of the upper gastrointestinal tract.

Roentgenographic examination establishes the diagnosis. A central mushroomlike negative shadow of the base of the duodenal bulb is typical. Medical therapy consisting of a bland diet, antispasmodics, sedation, and rest may suffice in the less severe cases. Surgery is indicated when medical management fails or when hemorrhage, obstruction, or equivocal roentgenographic evidence of pyloric tumor is present. Resection of the mucosal folds, combined with some type of pyloroplasty, gives uniformly good results.

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**GASTROINTESTINAL GAS: Observations on Belching During Anesthesia, Operations and Pyelography; and Rapid Passage of Gas, by W. G. Maddock; J. L. Bell; and M. J. Tremaine. Annals of Surgery 130: 512-537, Sept. 1949.**

There is nothing new in the idea that external air enters the esophagus under many conditions and is the major source of gastrointestinal gas. It appears in the upper alimentary tract of infants within 15 minutes after birth and the roentgenographic findings of air in the bowel has been suggested as a test for extra-uterine life.

Normally the superior esophageal sphincter keeps the esophagus closed. With swallowing movements the sphincter relaxes and air enters with fluid and food. In the upright position the air collects at the stomach, and when more than the usual amount accumulates, as with a meal, it is belched up. Alvarez remarked that hundreds of patients can be examined with the fluoroscope before finding one with enough air in the stomach to be worthy of special comment. \* \* \* appreciable volumes of air enter the stomach by repeated belching. In the upright position the air is trapped in the cardia and nothing more disturbing than further eructations result, but when to one the air may pass on and cause trouble. A patient with marked gastrointestinal distention from repeated belching is reported.

Patients undergoing anesthesia and operation were found to swallow infrequently, and little gas was aspirated from the stomach of the majority studied. Considerable gas was aspirated from the stomachs of five patients during an operation under cyclopropane anesthesia plus curare. Each was considered to have a partial paralysis of the respiratory muscles due to the curare and positive pressure anesthesia used. With curare the superior esophageal sphincter was probably well relaxed and the positive pressure forced gas into the stomach.

An excellent opportunity for studying rapid accumulations of intestinal gas was offered by patients undergoing pyelography. By continuous gastric suction considerable volumes of air were aspirated from the stomach, and when it was kept empty no increase in intestinal gas occurred. This is further evidence that external air is a major source of gastrointestinal gas.

The finding that continuous gastric suction prevented the meteorism of pyelography is the same as continuous gastric suction preventing postoperative distension. There is every reason to believe that patients under many conditions become temporary aerophagies and the stimulus may be entirely nervous without organic origin or be associated with an organic disease or injury and its treatment.—*Abstract.*



# Superior Vena Cava Obstruction

## Review and Report of Two Cases

JOHN B. McGRATH Commander (MC) U. S. N.<sup>1</sup>

ARTHUR W. STOOLMAN Lieutenant, junior grade (MC) U. S. N. R.<sup>1</sup>

THE superior vena cava syndrome is produced by any lesion which interferes with the flow of blood through the superior vena cava without a corresponding interference with the blood flow through the inferior vena cava. William Hunter (1) provided the first authentic description of superior vena cava obstruction in 1757. From that time until 1946, 524 cases have been reported (2); however, it is believed that the condition is much more common than the number of cases reported would indicate.

Any lesion which interferes with the blood flow through the superior vena cava directly or indirectly either by bilateral innominate vein obstruction or arteriovenous fistula between the ascending aorta and the superior vena cava, will produce the superior vena cava syndrome. The clinical picture is characterized by increased venous pressure in the areas drained by the superior vena cava, increased circulation time, the formation of collateral venous channels, and the presence of an obstructing lesion.

The syndrome occurs more frequently in men and the incidence is highest between the ages of 30 and 60, since the more common etiological factors—bronchogenic neoplasm, syphilitic aortitis, and malignant lymphoma—are more prevalent in men of this age group.

McIntire and Sykes (2) reviewed the literature and found malignant primary thoracic tumors, aneurysm, and chronic fibrous mediastinitis responsible for the obstruction in 75 to 80 percent of cases. Uncommon conditions which have been reported as a cause of superior vena cava obstruction include propagation thrombi, localized phlebitis with thrombus formation, tuberculous phlebitis, actinomycosis, benign thoracic tumors, metastatic malignant lesions of thoracic organs or breaking into a tributary of the superior vena cava and growing into the superior vena cava.

<sup>1</sup>U. S. Naval Hospital Philadelphia, Pa.

The large veins of the superior mediastinum are thin-walled and carry blood under low pressure, consequently the vessels are easily compressed and circulation through these vessels is readily impaired by space-filling lesions of the immediately surrounding structures.

The prognosis and the degree of invalidism depends upon the efficiency of the collateral systems.

There are four collateral routes for shunting the venous blood from the upper half of the body to the right auricle when the superior vena cava is obstructed. These are the internal mammary, the vertebral, the azygos, and the lateral thoracic (3).

The special studies indicated in patients with clinical evidence of superior vena cava obstruction include venous pressure studies, circulation times, phlebography, and infrared photographs. The venous pressure in the antecubital vein is greatly increased bilaterally while the venous pressure in the femoral vein is normal. A variation in the venous pressure of the arms with an increase in one arm is believed to indicate that there is an obstruction on that side in one of the tributaries to the superior vena cava, in addition to vena cava obstruction (4). Normally the venous pressure falls slightly on inspiration and rises slightly on expiration. When the respiratory effect on the venous pressure is reversed the obstruction is complete and lies below the entrance of the azygos into the superior vena cava. The arm to throat circulation time in superior vena cava obstruction is increased but not necessarily in proportion to the venous pressure. In the majority of cases where the venous pressure and the circulation time were reported, the circulation time was found to be disproportionately short. Phlebograms are of great value in outlining and evaluating collateral circulation, and at times will localize the site of the obstruction.

#### CASE REPORTS

**Case 1.**—A 23-year-old white man was admitted to the U. S. Naval Hospital, Philadelphia, Pa., on 16 March 1919, complaining of pain in the right chest of 3 weeks' duration. The patient believed himself to be in good health until December 1914 when he noted aching and swelling in the right leg which was thought to be due to varicose veins and these were treated with sodium morrhuate injections. The patient became symptom-free and remained well until December 1917, except for slight swelling and aching of the right leg after prolonged standing or walking. In December 1917, he noted a slowly progressive swelling in the left popliteal space which was associated with pain and swelling of the left leg. On 21 February 1918, an aneurysm was excised from the left popliteal space. At the time of operation extreme tortuosity of the veins in the popliteal area was noted. During June 1918, generalized edema of the neck and face was present on rising and gradually subsided during the day.

During October 1919, he first noted prominence of the superficial anterior chest veins. For 3 months prior to admission he was aware of light-headedness and bluish discoloration of the face upon exertion or bending over.

His family and past medical histories were noncontributory. The systemic review was negative except for a 17-pound weight loss during the 6 months prior



Figure 1



Figure 2.—Venogram of right axilla and chest.

to admission, and the infrequent occurrence of hand painful nodules along the superficial veins of the lower extremities.

Physical examination upon admission revealed a well-developed, fairly well nourished young man not in acute distress. The pulse was regular (100) and the blood pressure was 115/75. The hands were bluish red with cyanotic nail beds. The superficial veins of the arms and legs were very prominent and those of the anterior chest and ventral abdominal wall were tortuous, dilated, and filled from above (fig 3).

The remainder of the physical examination including fundoscopic examination was negative except for absence of the supraclavicular fossae.

Circulation time, using calcium gluconate intravenously, was: left arm to throat, 24 seconds; right arm to throat, 11 seconds; and left femoral to throat, 15 seconds.

Venous pressures were: left arm, 20 mm H<sub>2</sub>O; right arm, 280 mm H<sub>2</sub>O; and left femoral, 90 mm H<sub>2</sub>O.

A venogram of the right axilla and chest showed "no evidence of filling of the right axillary, subclavian, innominate, or superior vena cava. However, a rich anastomosis is demonstrated via the intercostal, internal mammary, and azygous veins close to the right auricle, where the opaque medium is presumed to have entered the heart" (fig 2).

A venogram of the left axilla and chest showed a rich anastomosis of blood vessels in the lower two thirds of the left half of the thorax. However, no opaque medium reached the left axillary, subclavian, or innominate veins.

All other laboratory studies were negative.

This case is believed to characterize the superior vena cava syndrome caused by a thrombus of the superior vena cava with extension distally to the innominate and axillary veins. The pathogenesis of the thrombus formation was not determined, however, the most logical basis was visceral thrombophlebitis migrans, as reported by Gerber and Mendlowitz (5).

**Case 2**—A 33-year-old white man was admitted to the United States Naval Hospital, Philadelphia, Pa., on 26 April 1949 complaining of painful, swollen joints. He had considered himself to be in good health until 4 months prior to admission when he had swelling and pain on motion of the right shoulder joint. In addition in the preceding 4 months he had swelling of the right hand and both ankles at intervals with associated anorexia, weakness, and weight loss.

**Past medical history:** He had had a ruptured peptic ulcer which was repaired surgically. He takes three "shots" of whiskey per day.

**Physical findings:** His temperature was 100.4° F., pulse, 120; and his blood pressure was 110/80. There was swelling and edema of the right arm and shoulder, with muscle spasm, increased skin temperature, and pain on motion. There was swelling and tenderness of the right foot and ankle.

**Laboratory findings:** The urine was normal; the blood Kahn test was negative; the white blood cell count was 26,500 per cu. mm., 58 percent polymorphonuclear neutrophils, 20 percent band forms, and 22 percent lymphocytes. The red blood cell count was 3.62 million per cu. mm.; hemoglobin was 10.5 gm.; blood sedimentation rate was 31 mm./30 min.

The initial impression was that the patient had rheumatoid arthritis, and salicylate therapy was instituted with a subsidence of the febrile state and subjective improvement. This drug was discontinued after 3 days because of severe tinnitus.

On 5 May 1949, the patient complained of severe pain in the right axilla which was exaggerated on inspiration and 4 days later periorbital edema and swelling of the anterior neck and face were noted.

Roentgenograms of the chest on 12 May 1949, revealed "a rounded area of density occupying the apical portion of the right upper lobe" (Fig. 3). The swelling of the face and neck persisted and fullness of the veins over the anterior wall was noted which suggested that partial obstruction of the superior vena cava was present. Also, palpable, nontender lymph nodes appeared in both axillae; biopsy showed "fibrosis of lymph node." Bronchoscopic examination and Papanicolaou stain of the secretions revealed no abnormalities. The electrocardiogram was within normal limits.

Venous pressures were: left antecubital vein, 520 to 540 mm. of sodium citrate with normal variation with respiration, right antecubital vein, 480 mm. of



Figure 3.—Roentgenogram of the chest (12 May 1949).



Figure 4.—Venogram of the chest.

# Hip Nail Corrosion

JACOB KUROWSKI, Commander (MC) U.S.N.R.

BY PRESENT-DAY metallurgical standards, one expects progressive corrosion in any steel implant in bone which differs essentially from so-called 18-8 5Mo stainless steel. Thus was not uniformly the case in three fractures of the neck of the femur which were observed about 12 years after pinning with what was then known as 420 stainless steel Smith-Petersen nails (table 1). Instead, there was marked corrosion in one nail, minimal corrosion in the second, and no corrosion in the third. These singular "biomechanical" incidents form the basis of this report.

TABLE 1

	18-8 Mo-stainless steel <sup>1</sup>	420 stainless steel
Chromium	17-20 percent	12-14 percent
Nickel	10-14 percent	
Molybdenum	2-4 percent	
Manganese	2 maximum	0.50 maximum
Silicon	0.35 maximum	0.50 maximum
Carbon	0.05 maximum	Over 0.15
Phosphorus	0.03 maximum	0.025 maximum
Sulfur	0.03 maximum	0.025 maximum

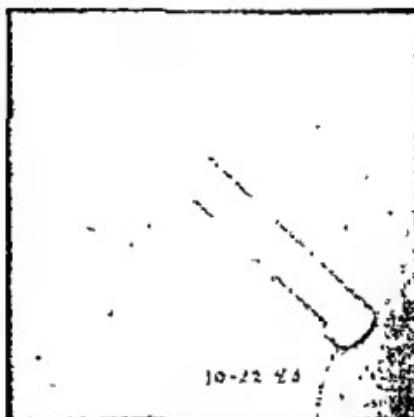
<sup>1</sup> Specifications for 18-8 5Mo. It shall have a hardness of not less than 30 nor more than 35 as determined by the Rockwell hardness tester using the 'C' scale and the 150-kilogram load on the diamond cone penetrator.

## CASE REPORTS

**Case 1**—M. C. was 61 years old in 1936 when her hip fracture (valgus deformity) was nailed by an open Whitman approach (fig. 1A). Seven years later she had a disabling coxartrosis which subsided somewhat with crutch walking in the next 2 years. Roentgenograms taken about 10 years after operation showed metallic corrosion with associated bone and joint changes (fig. 1B). One year later the patient walked without support. Roentgenograms taken 12 years after operation did not reveal further corrosion. Six weeks later the patient fell and sustained a subtrochanteric fracture of the normal hip. When this fresh fracture was operated upon, the corroded nail was also removed. Its head was covered by a dense fibrous capsule, excision of which permitted the nail to slip out easily. Curettage of the nail canal obtained a darkly pigmented



A



B



C

**Figure 1.—Case 1.** (A) Roentgenogram of the right hip, 10 weeks after open operation. (B) and (C) Same hip, anteroposterior and lateral views, 10 years after operation and 3 years after onset of coxalgia. Note metallic corrosion shaft of nail, widening of pin canal (fibrous capsule prevented extrusion of nail), increased density of femoral head, inferior condyle ossification, and thinning of the joint cartilage.

granulomatous tissue, microscopic examination of which showed old hyaline fibrous tissues heavily stained with golden brown pigment for the most part, but also showed various other stains, suggesting foreign material. The nail was blackened and partly encrusted (fig 2) with a granular material which was easily scraped off. Light sanding revealed a fairly polished surface except for some small pits and linear erosions. Only the manufacturer's name, which had been most deeply impressed, was practically effaced. Moreover, this flange showed the most extensive destruction.

**Case 2**—C. H. was 60 years old when her subcapital fracture (varus deformity) was nailed blindly early in 1937. She has remained asymptomatic. Roentgenograms taken 10 years after operation showed minimal corrosion near the head of the nail. Roentgenograms taken 2 years later showed no further damage.

**Case 3**—R. Z. was 47 years of age in 1936 when his fracture (neck of femur with varus deformity) was blindly nailed in marked valgus (fig. 3.1). A painful limp came on gradually several years later and became progressively worse.

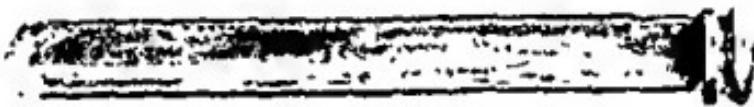
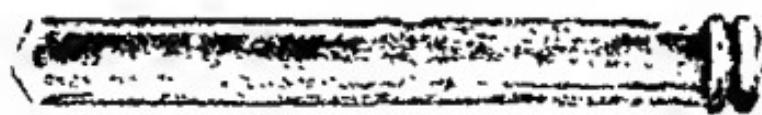
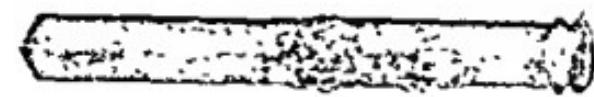


Figure 2—Case 1. Reading from top to bottom. Blackened encrusted nail at time of removal, two views after light sanding, and roentgenograms of the specimen.

Roentgenograms (fig. 3B) taken about 10 years after operation showed absence of corrosion and marked aseptic necrosis of the femoral head. This did not progress further 2 years later, at which time he was actively engaged in farming.



Figure 3.—Case 3. (A) Roentgenogram of hip, 2 months after blind nailing, with femoral head in extreme valgus deformity. (B) Same hip 10 years after operation. There is marked aseptic necrosis of femoral head and absence of corrosion.

#### COMMENTS

It seemed certain on the strength of case 1, that cases 2 and 3 would follow the same pattern of corrosion because the chemical composition of 420 stainless steel does not meet the requirements of bone surgery. Scheer's (9) definition of corrosion ("a destruction of a solid by 'unwished' chemical or electro-chemical attack originating from the surface") helps to explain the discrepancy. Therefore, rustlessness is not unconditionally an inherent quality but essentially an acquired one, for among other things such as homogeneous structure and proper chemical composition, it depends on the surface finish or protective coating. By alloying the steel with chromium a very thin but indestructible film of chromium oxide is formed to protect the steel against further attacks from the oxygen. It is absolutely necessary, however, that the surface be perfectly smooth and free from impurities, otherwise this protective film is not effective. The relative importance of proper surface finish is best illustrated by an early experience of the writer. The marked surface corrosion in that instance occurred in an unpolished stainless steel nail of unknown composition and was removed from the body less than 3 months after insertion in a 51-year-old woman (fig. 4). The nail had ploughed upward out of the femoral head and neck with resultant nonunion, considerable scarring, and

local brown to black discoloration of the bone and soft tissues, microscopic study of which showed transition into o-teond, osseofibrous, and dense fibrocartilaginous tissue. The softer tissue was pervaded by vascular channels and simple cells, both occupied by extremely hypertrophic, hyperplastic spindle cells which varied in form (frequently quite swollen) and stained with a brownish to greenish black pigment. The latter apparently contained activated fibroblasts and scavenger endothelial cells loaded with iron from broken-down blood cells and other pigment. The changes were indicative of tissue metaplasia from minimal trauma and irritation.

No special stains were made to determine the origin of the pigment in either of these cases. It was thought, however, that the pigment was derived both from the iron of the red blood cells and iron of the stainless steel. In Raagaard's case, special staining and chemical tests showed that the pigment, which was partly free in the tissues and partly located in wandering cells, was due chiefly to the nail.

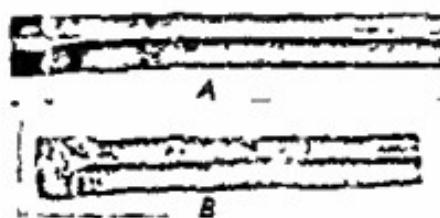


Figure 4.—(A) Unpolished stainless steel nail of unknown composition  
(B) Similar nail removed less than 3 months after insertion

In Raagaard's case, special staining and chemical tests showed that the pigment, which was partly free in the tissues and partly located in wandering cells, was due chiefly to the nail. The special stain reaction with diphenylcarbozide revealed chromium in the tissues. Felsenreich (2) stated that the

iron pigment derived from stainless steel occurs in the form of an organic iron. On the other hand, since the pigment noted by Wise (12) occurred in a specimen wherein a vitallium nail had been used, he argued that the iron pigment he noted must have been formed from the red blood cells because there is no iron in vitallium.

However important surface finish may be, the self-limited corrosion in depth notable in case 1 strongly suggested another deficiency; namely, that there was a structural inadequacy, as was proved in Raagaard's case. The latter corroded specimen had been removed from a 64-year-old man 15 months after insertion. The low chromium and carbon content of this nail closely approximated that of 420 stainless steel (0.45 percent carbon and 12.2 percent chromium). Microscopic examination showed faulty finish, numerous blisters, and impurities. Free carbides and considerable oblong slag deposits, showing that the nail had been made from rolled or drawn material, were found. Raagaard concluded that corrosion of his nail was due to a combination of faulty finish, excessive slag, and insufficient chromium.

Did mechanical stress have anything to do with the corrosion noted in cases 1 and 2? Speed (10) in 1935 asked the same question in regard to a similar case of his own. This question is a pertinent one since in case 3, in which virtually all shear had been eliminated by the extreme valgus deformity of the head after reduction and pinning, there was no corrosion. According to Panwels (7), the torque in the femoral head fluctuates in walking between 0-248 kilos during fractions of a second. This, according to him, causes steel to "exhaust" and eventually to break. Be that as it may, since there was no notable distortion of the nails, and since corrosion apparently did not set in until long after bony union had occurred, it does not seem probable that stress had anything to do with the corrosion in cases 1 and 2.

Another factor, which may have been of some importance in limiting or preventing corrosion, is the encapsulating membrane which forms about hip nails (fig. 5). This was first mentioned by Engel (1) who suggested that it aided in revascularizing the femoral head. Wise also described a grayish membrane in connection with a vitallium nail. The membrane developed as early as 43 days after insertion of an 18-8 SMo stainless steel pin in a post-mortem specimen (5). On the clinical side, successive roentgenograms show that these membranous canals become invariably widened distally and are always demarcated by a line of increased density and/or by well-defined rounded cystic areas about the head or point of the nail. The disruption of the canal and the pronounced atrophy and decalcification observed in case 1 were therefore especially notable and must have been due to a granulomatous inflammatory bone tissue reaction as a result of chemical and physical agents (3) incident to the corrosion. Felsenreich (2) refers to this reaction as "rust granulomata" and states significantly that these may be "recaptured" by fatty tissue and bone, if the nail is removed.

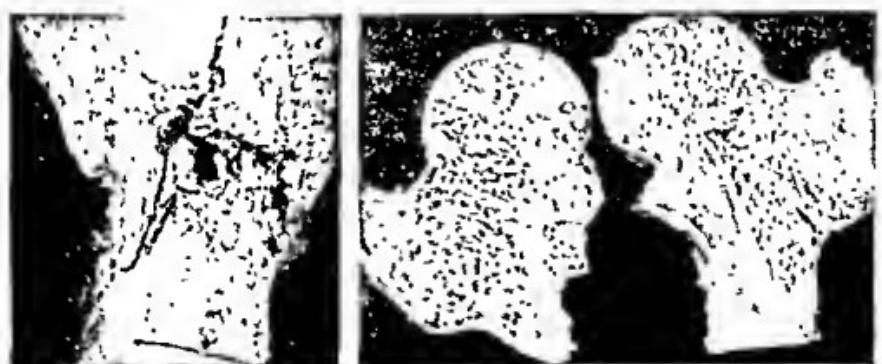


Figure 5.—Post-mortem specimen in a 63-year-old woman, about 3 months after operation, showing fibrous lining of pin canal.

Finally it may be asked, "What caused the bone and joint changes in cases 1 and 3?" In case 1, the aseptic necrosis must have been due in great part to an interference with the blood supply to the femoral head by the granulomatous infiltration of the femoral neck. In case 3, there must have been a mechanical vascular occlusion following reduction to a valgus position. It is to be remembered in this connection that triangular areas of aseptic necrosis of the femoral head frequently occur shortly after the initial trauma in this type of fracture; therefore, it may be concluded that uncomplicated steel implants here have little or no direct bearing to subsequent bone and joint changes which may occur.

#### CONCLUSIONS

1. The minimal corrosion in case 2 and the absence of corrosion in case 3 emphasizes the importance of proper surface finish (5).
2. It is possible that there is an "x" factor in corrosion which varies with different patients.
3. Bony union is irreversible in the presence of corrosion and is not affected by aseptic necrosis of the femoral head (6).
4. Bony union does not prevent metallic corrosion later.
5. Nails should be removed after bony union has occurred in order to prevent late corrosion and to enhance complete physiological restoration of the femoral neck and head.

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# Visceral Leishmaniasis

WILLIAM C. CACCAMISE, *Captain, MC, A. U. S.<sup>1</sup>*

**V**ISCERAL leishmaniasis, as in the United States, is not endemic in Japan. However, this disease has been diagnosed in a small number of Japanese who have returned to their homeland after military assignments in such highly endemic areas as China and India. An analogous situation has been seen in this country. A large proportion of these patients will show a satisfactory response to pentavalent antimony, but some will have repeated relapses after several courses of apparently adequate amounts of this drug. It is in such cases that stilbamidine may be indicated. Stilbamidine is a non-antimony compound that, in a limited series of cases in the United States, has given encouraging results in the treatment of antimony-resistant cases of visceral leishmaniasis. The general use of this drug has been limited by the relatively frequent occurrence of a trigeminal neuralgia that results from a toxic degeneration of the principal sensory nucleus of the trigeminal nerve, usually appearing 2 to 5 months after treatment. The numbness, formication, and itching slowly subside, but the dissociation anesthesia, which is evidenced by a loss of sensation to light touch may persist. The following case of visceral leishmaniasis was resistant to antimony but was successfully treated with stilbamidine. It was the first case in Japan to be treated with this drug.

## CASE REPORT

A 35-year-old Japanese veteran, while stationed in Northern China from May 1943 until June 1944, was observed for pulmonary tuberculosis. Study failed to reveal active infection, but in June 1944 he was returned to Japan for medical discharge. He felt well on his return to Japan until November 1947, when he complained of fever, abdominal swelling, and weakness. Physical examination revealed a poorly nourished man who appeared to be chronically ill. The oral temperature was 39.5° C. There was distinct pallor of the skin and mucous membranes and bleeding of the gums. The lungs were clear to percussion and auscultation. There was extreme protuberance of the abdomen. The liver was

<sup>1</sup>Formerly Military Government Public Health Officer of Chiba Prefecture, Honchū, Japan; now graduate in ophthalmology, Northwestern University Medical Center, Chicago, Ill.

interruption of treatment. After the fifth injection there was a subjective feeling of improvement. After the fifteenth injection the temperature became normal and remained so except for one 4-day period in February 1940 when the patient developed an upper respiratory infection. There was palpable softening of the spleen after the eighteenth injection. Since the completion of treatment there has been great subjective and objective improvement in the patient's condition. Within 2 weeks after the last injection the liver was no longer palpable. There was a rapid diminution in the size of the spleen. Within 3 months only the tip of the spleen could be palpated (fig 2). The patient rapidly regained his strength and was capable of light work.

A summary of the progressive changes that occurred in this patient's blood picture in the 9-month period following the initiation of stilbamidine treatment is shown in table 1. In that period multivitamins and ferrous sulfate were given and on 10 February hexylresorcinol was given for ascariasis.

TABLE 1.—*Progressive changes in the blood of a patient with visceral leishmaniasis after treatment with stilbamidine*

Date	Erythrocytes Million	Leukoocytes	Hemoglobin Percent	Sedimentation rate mm per hour	Formal gel test
1940					
1 Nov	1.42	3,100	37	over 130	4 plus
8 Nov	1.55	2,630	29	—	—
15 Nov	1.42	2,900	32	—	4 plus
3 Dec	2.04	4,100	52	—	3 plus
13 Dec	2.94	4,800	53	—	—
22 Dec	2.96	5,100	59	—	—
1941					
1 Jan	3.15	7,020	69	—	—
23 Jan	3.49	7,750	72	—	—
10 Feb	3.53	10,400	73	130	—
22 Feb	3.60	11,500	73	—	1 plus
16 Mar	3.60	8,660	85	—	70
24 Apr	3.64	7,940	90	—	22
8 June	3.92	2,250	89	—	13
4 July	4.10	9,000	94	—	9
14 Aug	4.15	5,880	90	—	Negative

### CONCLUSION

Visceral leishmaniasis must be considered in any patient who has lived in an endemic area and later develops anemia, leukopenia, and hepatosplenomegaly. Such a problem may be confronted in veterans who have served in China, India, and Turkey.

# Unusual Foreign Body in Conjunctiva

## Report of a Case

JOHN H. KING, JR., Lieutenant Colonel, U.S.A.<sup>1</sup>

VEGETABLE foreign bodies which become imbedded in the conjunctiva are common and are usually removed promptly. If such an object is not discovered shortly after the injury, the ensuing symptoms of eye discomfort and inflammation are usually so severe that removal is made necessary within a few days. A vegetable foreign body would rarely remain unnoticed for over a week.<sup>2</sup>

### CASE REPORT

A 10-month-old boy was referred in June 1949, for investigation of a "growth" on the left eyeball. The mother stated that she first noticed a red mass partially covering the left eye about 1 week earlier. A slight mucoid discharge had been present for a month. There had been no redness or swelling of the lids or globe. The child had been well generally but had not opened the left eye as widely as the right since an injury at the age of 6 months. Thirteen months earlier (May 1948), while playing on the lawn in San Diego, Calif., he fell into some freshly cut grass. The child cried continuously and the mother examined the left eye, discovering what appeared to be a grass seed imbedded in the globe near the lateral canthus. After removing the foreign body the child was taken to a hospital where further examination revealed an abrasion of the lateral bulbar conjunctiva. No other foreign bodies were found. All redness disappeared after several days and there were no further eye complaints except a mild mucoid discharge from the left eye accompanied by acute attacks of nasopharyngitis on two occasions. The discharge disappeared with the use of boric acid solution eye drops.

Examination revealed apparently normal vision and slight narrowing of the left palpebral fissure. External examination of the left eye showed a tongue-like, soft, red tissue mass protruding from the upper angle of the inner canthus and loosely flapping over the medial half of the cornea. Under ether anesthesia the mass was found to be freely movable, friable, and attached by a narrow

<sup>1</sup> Tripler General Hospital, Honolulu, T. H.

<sup>2</sup> SPARRE, F. H.: Principles and Practice of Ophthalmic Surgery. 4th edition. Lea & Febiger, Philadelphia, Pa., 1918. p. 590.

# Treatment of Creeping Eruption With Hetrazan

## Report of 13 Cases

SAMUEL H. HORTON, JR., Lieutenant Commander (MC) U. S. N.<sup>1</sup>

**C**REEPING eruption is a term applied to a number of diseases of the skin characterized by tortuous migratory lesions produced by the burrowing of larvae. Persons who walk barefoot on the beaches, children in sandboxes, and plumbers and carpenters who work under houses are often victims. The majority of cases in this country are due to the penetration of the skin by larvae of the cat-and-dog hookworm. The disease is endemic along the Atlantic coast, particularly in Florida and Georgia, but has been reported as far north as the coast of New Jersey.

The present accepted treatment consists of freezing the affected areas with ethyl chloride spray or injections of fuadin. Shelmire (1) is credited with being the first to propose the use of ethyl chloride spray and Smith (2) was the first to suggest the use of fuadin. Both treatments, although usually effective, leave much to be desired. Ethyl chloride must be used until the skin is firm and can be picked up between the fingers like cardboard. Multiple treatments are usually necessary. Children often are affected about the genitals, buttocks, feet and toes, and these areas are difficult to treat and the procedure is quite painful. The young patients are brought screaming to the doctor's office and several people are needed to hold the victim. The skin is often macerated and secondarily infected, further complicating the use of ethyl chloride spray. Fuadin is occasionally toxic and a careful check must be made on the kidneys and blood. In addition, the patient has to report daily for the injections. The need for a non-toxic helminthicide, taken orally and effective against the larvae of *Ancylostoma brasiliense*, is self-evident.

Oliver-Gonzales et al. (3) reported the treatment with hetrazan of 23 patients infected with *Wuchereria bancrofti*.

<sup>1</sup> U. S. Naval Hospital, Jacksonville, Fla.

Fifteen months after therapy, 13 patients (56.5 percent) were found free of infection. The remaining 10 patients had *Wuchereria bancrofti* microfilarial counts but no evidence of a relapse. The doses ranged from 0.5 to 2 mg. per kg. body weight, given orally three times daily. They noted that the patients receiving the larger doses had the best response. They concluded that tetrazan, when given in adequate dosage to patients infected with *Wuchereria bancrofti*, cleared the blood stream of microfilaria for periods of at least 15 months.

Since 28 June 1949, 21 cases of creeping eruption have been seen at the U. S. Naval Hospital, Jacksonville, Fla. The youngest patient was 18 months of age and the oldest, 49 years. There were 10 males and 11 females. The number of active larvae varied from 2 to an estimated 25. The most common site of infection was the foot, particularly around the toes, and these patients were often referred with a tentative diagnosis of epidermophytosis. The buttocks and genitals were often involved; the hands, back, and legs, rarely. All patients or parents could give a definite time of infection, usually immediately following a picnic, beach party, wading in ponds, playing in sandpiles, or working in the yard. The latent period from the initial penetration of the skin by the larvae until symptoms appeared was usually less than 48 hours and often in a few hours. Most patients thought they had been bitten by mosquitoes, sand fleas, or ants since small discrete papules were initially evident. In a few days the migrations of the larvae were plainly visible. The intense pruritus was usually worse at night. The patients slept fitfully, often clawing the offending areas viciously. Children cried out in their sleep and awoke sobbing and scratching. Patients have been known to mutilate their bodies with penknives and needles in a fruitless effort to rid themselves of the burning pruritus.

#### TREATMENT

Of the 21 patients with creeping eruption, 7 were transients who could not be seen regularly and were treated with ethyl chloride spray. Due to a temporary shortage of the drug one had combined therapy. Thirteen were treated with tetrazan (diethylearbamazine) alone. These patients were weighed carefully and the dose computed on 2 mg. per kg. body weight three times daily before meals. Children and adults received the same relative dose. Initial roentgenograms of the chest were taken because Loeffler's syndrome has been reported with creeping eruption (4) (5). Follow-up roentgenograms were taken in instances where there were significant complaints or a dry hacking cough. Only one case of Loeffler's syndrome was noted. Complete blood counts and urinalyses were done twice weekly and each patient

was instructed to report any nausea, vomiting, cramps, diarrhea, or general malaise. Not a single untoward reaction was reported with the dose employed. Several facts are worthy of note. The pruritus usually became minimal in 48 to 72 hours. If the patient forgot to take the drug or was temporarily without it the pruritus usually returned. The number of active larvae, as measured by their activity, gradually decreased rather than all ceasing at the same time. The average time required to acquire clinical cure was about 3 weeks although one patient required only 8 days; another required 30 days, but after the first week there was little complaint. Perhaps a higher dosage would effect a more rapid cure. One patient was apparently well in 9 days but noted larval activity 1 week later. He was re-treated, employing the same dose, and a permanent cure was effected 17 days later. Since this patient was the only one with roentgenographic findings characteristic of Loeffler's syndrome the case will be presented in detail.

#### CASE REPORT

P. E. P., a 28 year old man, was referred with a tentative diagnosis of contact dermatitis. Three weeks previously he had weeded his garden for about 3 hours. The soil was sandy, warm and moist. That night he experienced pruritic papules like "ant bites" over the dorsum of the right hand. The next day a linear vesicular dermatitis was apparent and he consulted a physician who advised benadryl and moist heat local compresses. The dermatitis continued in spite of numerous treatments and a course of penicillin.

On examination the right hand excluding the thumb, was swollen and stiff. The skin over the dorsum of the little finger was macerated and erythematous. Numerous wavy, vesicular linear lesions, some curled on themselves and some crossing others, were present on the back of the hand, in the palm, and circumventing the third, fourth, and fifth fingers. Right epitrochlear and axillary adenopathy were present. Hetrizan, 2 mg per Kg body weight three times daily before meals, and aluminum acetate (1:20) wet dressings were prescribed. The response was dramatic. In 9 days the skin was normal except for a small area of hyperpigmentation over the dorsum of the little finger. A 21 percent eosinophilia was reported. The admitting roentgenographic examination of the chest was interpreted as being compatible with allergic pneumonitis (Loeffler's syndrome). The roentgenographic findings of the chest 1 week later were negative.

The patient was discharged to duty but returned in 7 days with four demonstrably active larvae. He was again given hetrizan and the skin became clear in 17 days. He has remained asymptomatic.

#### RESULTS

Of the 13 patients with creeping eruption who were treated only with hetrizan, 9 (69 percent) were clinically cured. Two failed to return for their final check-up but since both were progressing satisfactorily when last seen it might be assumed that they were cured and saw no need to make an unnecessary trip to the hospital. However,

these two are included in the four failures. The accompanying table illustrates the important features of these 13 cases.

TABLE 1

Case	Age (years)	Sex	Weight (kilograms)	Roentgenogram of chest	Average eosinophilia (percent)	Number of days	Result
1.....	28	M.	85	Area of pneumonitis on right side opposite seventh inter-space	21	26	Cured
2.....	8	F.	24	Negative.....	2	21	Cured
3.....	5	M.	18	Negative.....	3	30	Cured
4.....	5	M.	19.8	Negative.....	11	19	Cured
5.....	4	M.	16	Negative.....	1	-	Failed to return
6.....	22	F.	70.2	Negative.....	8	20	Failure
7.....	18	M.	75	Negative.....	6	17	Failure
8.....	9	F.	30	Negative.....	9	22	Cured
9.....	23	M.	60	Negative.....	5	20	Cured
10.....	14	F.	59	Negative.....	8	8	Cured
11.....	23	F.	59	Negative.....	7	-	Failed to return
12.....	11	M.	54.5	Negative.....	7	19	Cured
13.....	1.5	F.	10	Negative.....	2	9	Cured

## SUMMARY AND CONCLUSIONS

1. Of 13 cases of creeping eruption treated with hetrazan there were only 2 known failures. Two failed to return for a final examination but were progressing satisfactorily when last seen.
2. Hetrazan is a safe, nontoxic, effective treatment of creeping eruption.

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persists for a long time with milder measures. Do not increase the erythema and edema and denudation of an acute dermatitis by using strong agents. Anything that makes the dermatitis or itching worse is too strong for that particular patient's skin. If in doubt, get expert dermatologic help before irreparable changes occur.

(d) Prevention Reduce the factors that support fungus growth such as: (a) careful and gentle daily washing and removal of dead skin, especially between the toes, with a bath towel; (b) liberal use of a dusting powder between the toes, in the groin, and in the axilla in the morning helps to reduce moisture; (c) low quarter shoes or ventilated shoes (in civilians) will help reduce the heat, moisture, and maceration.

Persons vary in their sensitivity to fungi and some have to be more particular than others in controlling the conditions for fungus growth. Occasionally a mild fungicidal ointment at night may be required by some patients. If a patient is active, ointments applied during the day increase the maceration and are poorly tolerated. Fungistatic foot powders (Army issue, or desenex) are useful for daytime application.

C Scabies Although the management of scabies does not usually cause much difficulty, the disease serves to illustrate further the mechanisms by which dermatitis may be produced. Wartime studies are a basis for much of this information. The disease is caused by the *Scoropotes* mite, which can live for only short periods outside the human skin and is acquired principally through contact with the skin of an infested person. When a person who has never had scabies is infested for the first time, the mites burrow into the epidermis, multiply there, and spread to many sites over the body. For 4 to 6 weeks the patient has no itching and no typical red papules, wheals, or vesicles. After this incubation period, the skin apparently becomes sensitized to the mite and then the body responds by an inflammatory reaction with vasodilation and pouring out of intercellular fluid, which produces the visible lesions of scabies and are accompanied by itching. If the patient gets warm, the peripheral blood vessels of the skin dilate; this increases the reaction in each lesion and causes intensification of the pruritus. This same mechanism explains why patients with other types of dermatitis also have increased itching when they get warm. The itching of scabies, therefore, is probably not related to movements of the mite, for the mites are just as active before the patient is sensitized and before the patient notices any pruritus.

If a patient who has had scabies and has been cured is reinfested, itching and typical inflammatory reactions appear shortly after the mites burrow into the epidermis because the epidermis apparently remains sensitized from the first infestation. The basic mechanism by which scabies lesions appear is analogous to fungus infections, in

that it is a type of contact dermatitis in which the *die-* or mite resides in the epidermis itself. The aim of treatment is to kill the self-perpetuating "antigen." It is apparent, however, that even though the mites are killed and a thorough bath is taken some of the mite products may not be eliminated for several days. This potentially explains the persistence of pruritic lesions for several days after adequate antiscabietic therapy. In addition, secondary infection and an irritative dermatitis may have been produced which in itself may persist after all mites are killed and removed.

The treatment of scabies has been simplified and improved by the introduction of new effective nonirritating scabieticides. The formulas for two of the best and safest are:

(a) Benzyl benzoate emulsion (commercially available and supplied as a 50 percent oily liquid), and water of equal amounts to make 100 percent.

(b) Benzyl benzoate (an oily liquid), 10 percent; DDT powder, 1 percent; "benzocaine" powder (local anesthetic and ovicide), 2 percent; "tween 80" (an emulsifier), 2 percent; and water, to make 100 percent.

The treatment of scabies always begins with a prolonged warm soap bath or shower to remove crusts, scabs, and thickened epithelium that might prevent the scabieticide from reaching the mites. The skin is then dried and one of these preparations is applied generously to all parts of the body from the chin down, paying particular attention to the genitals, anal area, hands, and other involved sites. The material is rubbed in well and allowed to dry. The same clothing may be worn. If the hands are washed during treatment, another application should be applied to that area. The next morning, the patient takes a shower bath, dons fresh clothing, and changes bedding. If adequately applied, one treatment is almost always effective, but in some patients it may be desirable to apply the medication twice and thus continue the treatment for 24 to 36 hours instead of the usual 12 hours. To prevent relapse, all suspected contacts must be treated simultaneously. If severe secondary pyogenic infection is present, intramuscular penicillin may be added to the above routines.

The second preparation is also the treatment of choice for pediculosis capitis and pubic lice. Children or infants with scabies are treated in the same way, but careful application of the material to face and scalp may also be necessary in those only a few months old. Following one adequate course of treatment no scabieticides should be reapplied for at least 10 days. If an irritative dermatitis and itching persist, basic shake lotion, or calamine liniment (N.F.) are prescribed. Remember, the causative mites are almost certainly destroyed by one treatment. After that, treat the resulting dermatitis as gently as any other dermatitis.

# Relationship of Bullous Staphylococcal Impetigo and Exfoliative Dermatitis of the Newborn

CLIFFORD D. GOLAN, JR., Lieutenant junior grade (MC) U. S. N. R.  
AVERT L. COLEMAN, Lieutenant junior grade (MC) U. S. N. R.  
JOHN O. RYDEEN, M. D.

**A** RECENT epidemic of bullous staphylococcal impetigo which developed in the newborn nursery of a naval hospital revealed the close association of impetigo and exfoliative dermatitis. Of 80 infants exposed in the nursery during a 4-week period, 20 developed a disease of the skin, 4 of whom presented manifestations resembling *dermatitis exfoliativa infantum* (Ritter's disease) (1). The remaining 16 infants showed at least 1 of 3 types of similar but less severe skin lesions: (a) vesicles coalescing and rupturing to leave large areas of exfoliation, (b) large discrete bullae, and (c) multiple tiny vesicles and pustules.

Under the title "Exfoliating Dermatitis of Nursing Infants," Ritter (1) in 1878, described an exfoliating disease of the skin which, at present, bears his name. The disorder usually begins as a red exfoliating patch on the lower portion of the face, although it may appear first on any part of the body. The initial lesion spreads rapidly until the entire surface of the body is red and exfoliating. In some instances, vesicles and bullae appear early. The mucous membranes of the mouth, nose, and conjunctiva may be involved. The skin beneath the exfoliating portion may present a moist or dry surface. Most often the surface is moist, weeping, and crusted. Early in the disease, slight pressure will cause the superficial skin layer to be separated from the corium (Nikolsky's sign). The disease is said to occur between the second and fifth weeks of life and, in Ritter's time, a mortality of 41 percent was noted.

\*U. S. Naval Hospital, Portsmouth, Va.

### EPIDEMIOLOGY OF OUTBREAK

A survey of the epidemiological aspects of this outbreak in the nursery was of little value in determining whether any person, or whether a break in aseptic technique, was responsible for the epidemic. It was of interest, however, that cultures of the throats of all the staff and nursery personnel revealed that, of the 20 persons from whom cultures were taken, 9 (45 percent) were harboring an organism thought to be identical with that cultured from all the infected infants. This is in accord with a report by McFarlan (2) who found a similar high percentage of normal persons harboring pathologic forms of staphylococcus. Further information was obtained from the nursery records. It was noted that for several months prior to the outbreak there were numerous references to such diseases as diarrhea, skin eruptions, and cord infections. The overcrowded conditions in the nursery prevented proper isolation of these patients. These instances of infection, although seemingly minor in importance at the time, should have been a warning.

### DESCRIPTION OF OUTBREAK

On 12 October 1947 a newborn infant, H. H., was readmitted to the hospital and isolated because of a severe skin eruption. Within 10 days a total of 20 infants born in this institution were found suffering with a similar skin disease. The epidemic proportions of the disease process were thus soon apparent.

Cultures from the throats of the 20 affected infants revealed non-hemolytic *Staphylococcus albus* predominating in 17. From the throats of 2 infants, Friedländer's bacillus and hemolytic streptococci were cultured. In 1 infant the throat culture revealed gram-negative diplococci. Cultures of the skin, skin lesions, and bullae revealed non-hemolytic *Staph. albus* in pure growth from 18 and predominating in 2. Blood cultures taken from each infant showed no evidence of bacteremia.

### CASE REPORTS

The case reports of one infant with so-called Ritter's disease and one infant with bullous impetigo are presented:

**Case 1.**—K. M., a 12-day-old white boy appeared normal until the eighth day of life. On the eighth day, however, the mother washed the skin from the buttocks and penis. She immediately took the infant to a physician whose examination revealed that very slight pressure to the forehead and cheeks would separate the superficial layers of the skin from the deeper tissues, leaving open, weeping, raw areas. The infant was hospitalized under the care of one of the authors (J. O. R.).

On physical examination at admission the infant appeared in no acute distress despite the severity of his skin involvement. The skin showed a generalized eryth-

area especially noticeable around the mouth and eyes. There were a few tiny vesicles scattered over the chest and forehead, the eyelids were red and swollen. Slight pressure on almost any portion of the skin removed the superficial layers from the deeper tissues.

The infant's course while in the hospital was uneventful except for several loose, watery green stools. Cultures of the throat revealed the presence of Friedländer's bacillus and hemolytic streptococcus. On the fourth hospital day the infant was transferred to the U. S. Naval Hospital, Portsmouth, Va., to a ward specially equipped to accommodate the infants affected in this epidemic.

On admission to the naval hospital he presented a generalized redness and exfoliation of the skin. The scalp appeared to be involved in a severe seborrheic eczema but this skin unlike that in eczema, could be peeled off in large sheets leaving in place dry new skin and in others, open, weeping areas. The skin over the rest of the body showed eczematous changes and was rough and leathery to the touch. The remainder of the examination was essentially normal. The child was afebrile and appeared alert.

The laboratory examinations showed a normal urinalysis, hemoglobin 11.5 gm per 100 cc blood, red blood cell count, 3.8 million per cu mm, and white blood cell count, 16,000 per cu mm, 67 percent of which were polymorphonuclear cells, 21 percent lymphocytes, 5 percent eosinophils, and 4 percent monocytes. Cultures of the skin and throat showed an almost pure growth of nonhemolytic *Staph. albus* and no evidence of Friedländer's bacillus or streptococci.

On the second hospital day, the parents appeared and were concerned about their development of lesions similar to those that had initially developed on their child. In the mother's left axilla were several bullous impetiginous lesions and on the father's forehead and around the angles of his mouth were several small, impetiginous lesions. Cultures from these lesions showed almost pure growth of nonhemolytic *Staph. albus*.

The infant's hospital course was essentially uneventful. He took his feedings well and showed no further diarrhea. He was discharged from the hospital on the seventh hospital day. The skin at that time was entirely normal and the child was consulted to be in normal good health.

**Case 2**—W. S. J. was discharged from the nursery at the age of 5 days. On the seventh day of life the parents noted tiny pimplies in the diaper region. During the following few days prior to admission this area grew progressively more inflamed and the pimplies became larger.

The infant was admitted to this hospital on his fifteenth day of life and the initial physical examination showed a male infant in no apparent distress and with no abnormalities except for the skin. There was a definite crepitus around the lower portion of the face and neck and in the skin folds and creases. The skin over the lower portion of the abdomen was covered with numerous large bullae. The area surrounding these bullous lesions was a deep purplish red, the maddicus was moist and weeping; there was a slight purulent excretion from the left eye.

The laboratory findings showed 4.9 million red blood cells per cu mm, 17.5 gm hemoglobin and 8,500 white blood cells per cu mm, 48 percent of which were polymorphonuclear cells, 46 percent lymphocytes, 2 percent monocytes and 2 percent eosinophils. Cultures of the throat and skin revealed pure growths of nonhemolytic *Staph. albus*.

The hospital course was uneventful. The lesions healed rapidly and the infant was discharged on the sixth hospital day.

## DISCUSSION

In view of our findings of exfoliative dermatitis in its classical form in 4 of the 20 infants affected in this epidemic and because of its apparent contagiousness (case 1), we agree with a number of authors (10) (11) (12) (13) (14) (15) in suspecting that so-called Ritter's disease merely represents a severe reaction to a bacterial invader. A number of theories have been offered to explain the etiology of Ritter's disease. It has been considered a pathologic expression of the normal exfoliation of the newborn (3); a form of hereditary epidermolysis bullosa (4); a nutritional disturbance of the superficial layers of the skin (5); a temporary dysfunction of the endocrine system (6); a primary avitaminosis (8); and a fundamental deficiency of the skin and mucous membranes (7). Skinner (9) suggested that a diffuse peripheral vascular lesion was the cause.

All the infants in this outbreak were remarkable because very few systemic manifestations of a disease process were present despite the malignant nature of the skin lesions. The only clinical evidence of systemic disease in these babies on admission was a leukocytosis with an increase in the polymorphonuclear cells and, in one infant, a rectal temperature elevation to 102.6° F.

Therapy was maintained on as uniform a schedule as possible. One cubic centimeter of a solution of crystallin penicillin (5,000 units per cc.) was given intramuscularly every 3 hours until the skin lesions disappeared. In three infants from whom skin specimens for biopsy were obtained, local applications of penicillin ointment (500 units per dr.) were applied to the site. In infants with extreme exfoliation and weeping lesions, supportive whole blood transfusions were given.

Recovery in each infant was entirely uneventful. In those infants in whom the superficial layers of the skin were removed by the disease process, healing occurred with a thickening or eczematization of the skin. This thickening remained apparent in the more severely affected infants for periods as long as 2 weeks but gradually cleared, leaving soft skin. During recovery a number of infants showed an increase in the percentage of eosinophils. In one infant, the eosinophils, at one point, accounted for 28 percent of the white blood cells. However, this is a frequent finding in patients suffering with general dermatosis (14).

No infant in this epidemic required hospitalization for more than 2 weeks. We attributed the absence of deaths to the fact that the infecting agent was sensitive to penicillin and that we were able to provide adequate nursing and medical care.

## SUMMARY

An epidemic of contagious staphylococcic impetigo in the nursery of the newborn of a naval hospital resulted in the development of skin

lesions in 20 infants. Four of the twenty developed skin manifestations characteristic of Ritter's disease. The observations made during the epidemic show the close relationship between Ritter's disease and impetigo, making it appear that so-called Ritter's disease may represent a severe form of impetigo. The infecting agent in this epidemic appeared to be nonhemolytic *Staphylococcus albus*.

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# The Individual in Confinement

JAMES N. WILLIAMS, *Captain (MC) U. S. N.<sup>1</sup>*

**T**HE individual in confinement is rarely considered as a definite personality but one of a group that has committed an offense and must be punished.

Confinement for a period of time is usually considered the type of punishment indicated for most military offenses and disciplinary barracks were established for such a purpose. The person sentenced to an institution for confinement loses his identity and becomes a prisoner with a number. He has "failed in the service" and, in the "eyes" of most people, "brought it all upon himself."

A more constructive attitude can be gained by considering the characteristics of the person in confinement and attempting to understand the reasons for his behavior, which deviated from the normal accepted standards of the group.

## METHOD OF STUDY

One hundred cases were taken at random from the files, carefully analyzed, and the data tabulated (table 1). These records were the results of examinations of men confined to the disciplinary barracks, San Pedro, Calif., during 1948. All these men had complete physical examinations, psychiatric examinations, and psychological studies. Initial interviews were available and later a social history was obtained from the home community. The largest amount of material was compiled during their initial 2-week quarantine period and before the man had an opportunity to discuss his affairs with other prisoners. This same method of study is followed in each man admitted to this institution. It is considered essential as a preventive measure and also helps with placement of the man in some definite occupational field. The educational department administers a battery of tests to each man in order to offer vocational guidance and to help him plan for the future.

<sup>1</sup> Psychiatrist, U. S. Naval Disciplinary Barracks, San Pedro, Calif.

TABLE I.—Characteristics of 100 unselected prisoners, U. S. Naval Disciplinary Barracks San Pedro Calif., 1948

Home conditions		Type of offense—Continued
Good	5	Disobedience of orders.....
Average	6	Sleep on watch .....
Marginal	55	.....
Broken	34	.....
School (average grade claimed).	8.8	100
Type of offense	—	Average age (years) . . . . . 23
Theft	11	Race
Robbery	4	White ..... . . . . . 87
Desertion	44	Negro . . . . . 6
A. O. I.	23	Other.. . . . . 7
Scandalous conduct	5	Probation violators . . . . . 19
Assaulting another	2	Martial status
Striking an officer	2	Married . . . . . 34
Selling Government property	4	Single . . . . . 66
Stealing Government property	3	Previous honorable discharge (per- cent) . . . . . 39

#### ABOUT THE INDIVIDUAL IN CONFINEMENT

Many of these men had been in orphanages, then homes disrupted either by the death of one parent or divorce of the parents. As a result of this they had no opportunity to establish any strong family ties. This condition prevented the development of an adequate super ego and is revealed later by his lack of fear of punishment for misbehavior. Such home conditions also affected the school adjustment and caused them to leave school at an early age. In many of these men the instability of the home was reflected in their conduct in school and resulted in their expulsion from school. In a small number the financial situation made it necessary for them to leave school at an early age to support the home. The range of ages extended from the oldest, 39, to the youngest, 17 years of age. The type of offenses committed reveals that 67 percent were absence offenses, i. e., 44 percent were desertion and 23 percent were absent over leave. Theft constituted only 11 percent of the offenses.

This brief summary gives a picture of a person from a very poor home who has had little security and never developed any strong family ties. He is 23 years of age and his offense was absence over leave (67 percent of cases). The majority of these men have evidence of difficulty in adjusting to their environments from childhood. The usual history is that he had difficulty in school and was expelled. Many of them have a juvenile record and a small percent were sent to industrial schools because of stealing or incorrigibility. Only a few give a history of any serious illness or periods of hospitalization prior to their enlistment in the service, so they may be considered physically healthy persons.

## REACTION TO CONFINEMENT

During a period of confinement, opportunity to study the individual more closely and observe his reactions to situations was considered of great value. Frequent interviews were possible with each man during his period of confinement; in addition, group therapy proved to be helpful both to the individual and also to the staff in understanding individual problems. The same emotional reactions to confinement were very clearly demonstrated in individual discussions and in group therapy. The majority of the men manifested a strong resentment toward their confinement and had a deep sense of rejection. The feeling that they failed in the service apparently activated feelings of inferiority that existed from childhood and caused them considerable anxiety. In many men the anxiety was so acute that hospitalization was necessary shortly after their arrival in the institution. All the men were under considerable tension because of their strong resentment and their feeling that they were being rejected by the service. There was always a strong desire for revenge and as a result very definite paranoid trends were common among the group. These men tended to project their difficulties upon others and showed little ability to accept much responsibility for their actions. They compared themselves with persons who commit civil offenses in an effort to minimize their own inability to adjust.

The majority of the men blamed their difficulties upon illnesses of members of their families or their wives and thus they justified their reasons for being absent over leave. It was noted particularly during the initial interviews that the men gave only one single reason for their offense, either illness of some member of their family, marital discord, or drinking (which occurred in 11 percent of this group). In subsequent interviews other factors were often revealed as having a very definite influence upon his behavior. These other factors, such as some unsatisfactory situation at home or inability to obtain satisfactory employment, were often the reason for enlistment. The man who thus came into the service to escape some unpleasant situation soon found that he could not adjust adequately to the demands of the naval service and began to project his difficulties upon others and to seek an escape. This was apparently the same pattern that was followed from early childhood and he had little understanding of what was really causing him difficulty. The individual's only method of adjustment was by projecting difficulties upon others and developing a hostile paranoid reaction in an effort to protect his feelings of inferiority.

The desire for some type of revenge was very striking in the group and is apparently common to all persons in confinement. Some of them managed this on a passive basis whereas others were openly

aggressive in their desires for revenge upon those who they believed were responsible for their confinement. In many instances these paranoidlike feelings were widespread and showed no channelization or direction but included anyone who frustrated them in the slightest way. During the period of confinement these trends had to be controlled rigidly to prevent additional difficulty. Thus the majority of prisoners had multiple psycho-somatic symptoms.

### EMOTIONAL FACTORS

The striking characteristics of the prisoners were their lack of self-criticism and the inability to accept responsibility for their behavior. The man made an effort to protect himself from feelings of insecurity and inferiority by projecting his difficulties upon others. Few gained any insight into this reaction. Even in individual therapy it was difficult to develop an attitude of self-criticism, and if the man did gain some insight into his difficulties he was amazed to consider for the first time that he was at fault. The majority in this group showed very definite lack of identification with their parents or any strong parental substitute and as a result of this they were very easily influenced and dependent upon others. The group identification was very strong, and each prisoner was quite willing to fight the battles of his fellow prisoners, feeling that they were being persecuted and this was a means of getting revenge.

The majority of men in confinement were extremely sensitive about their position and became very emotional when treated in what they considered a derogatory manner by others. Each one appeared to be striving to protect his own ego against overwhelming odds and yet to conform to the demands of the group. As a result of this situation the man was caught between the rigid rules of the institution and demands of the group confined. His ego was further crushed by rigid disciplinary regulations on one side and demands of the prisoner code on the other side. To protect his ego he used any method possible to gain recognition and there were several ways in which this was attempted. One was by means of rebellion so that he could gain the recognition from other prisoners for his ability to thwart the authorities. There was also the rigid code that the man must adhere to, and that is, of never giving information about others or suffer being labeled as a "white rat." The majority of men followed the rules and attempted to gain recognition by obtaining other special privileges (wearing different shoes from the general population of prisoners or sitting in a special place in the auditorium when moving pictures were shown) as this satisfied their ego striving to some degree. Few realized the antagonism to authority was simply the pattern that was developed in the poor home situation and was the result of childhood traumas.

In those persons who had prolonged psychotherapy these patterns were easily revealed to them and in the majority of instances there was a definite alteration of their reactions after this time. Anxiety was one of the factors in all prisoners, and each developed his own method of managing his anxiety unless the pressure became too great. There were very few prisoners whose anxiety was not of such a degree that when regulations were rigidly enforced they developed more symptoms and found it difficult to control these symptoms. This indicated that their anxiety was greatly increased and beyond their control, and frequently panic states developed; during these periods the men abandoned all caution and care. However, during these periods of intense anxiety, in the majority of such instances, the men were either brought to sick bay or came of their own accord. Another period of intense anxiety occurred during the weeks prior to discharge from the institution; they feared something would obstruct or prevent their release at the time specified and they had great difficulty in controlling these fears. Frequently, just prior to his release, it was necessary to admit the man to sick bay for further treatment to help him control the symptoms associated with such a state of anxiety.

#### SEXUAL CONFLICTS

Sexual conflicts were prevalent in a large number of prisoners but were controlled satisfactorily. It was rare that sexual episodes were noted among the prisoners, although they were very conscious of such behavior. Apparently the verbalization of sexual conflicts, the hostility, and symptom formation was sufficient to control overt sexual behavior. Those men with known homosexual habits were usually segregated and later transferred to the Disciplinary Barracks at Portsmouth, N. H. There were many who had overt homosexual tendencies but controlled them well under supervision. With treatment these men had little or no difficulty, because they were able to control these habits satisfactorily while in confinement. States approaching panic reaction were frequently encountered in persons with sexual conflicts intensified by confinement.

#### TREATMENT

The treatment program at the disciplinary barracks has been difficult because of the large number of men needing individual therapy. Practically all the persons admitted had multiple emotional conflicts that had caused difficulties since early childhood, and their confinement was largely the result of following the same pattern of behavior. Each man hoped to escape confinement by some means and many had hope that a medical survey might be a means of escaping their period of confinement. There was also considerable resistance to treatment as

each one was reluctant to give up his pattern followed for many years. This was clouded by intense feelings of hostility toward authority. Group and individual therapy was used to the widest extent but in special cases other forms of treatment such as sub-shock insulin and narcoanalysis were used. It is believed that the various methods used achieved some success in the majority of the prisoners and at least made them conscious of their own inner conflicts to some degree. With the limited staff, extensive treatment of each man was impossible and only a small number were given individual therapy. Many instances can be cited where the person's aggressive hostility was impossible to control, until he gained some insight into the causes of his reactions. Afterward he made a very satisfactory adjustment to the institution.

At the present time there is no method of obtaining information about the person's adjustment after discharge to determine the value of the psychiatric program. Many of the prisoners showed a definite change in attitude toward confinement after psychiatric treatment but the "carry over" effects after release cannot be evaluated.

#### SUMMARY

An attempt has been made to give a composite picture of the average man sent to the disciplinary barracks, San Pedro, Calif., in order to afford a better understanding of the cause of his failure to adjust to the naval service. Whereas, the majority of prisoners (67 percent) were convicted of absence offenses, there were others convicted of more serious offenses (including murder, theft, and assault). Neither the seriousness of the offense nor the fact that a certain percent had a record of honorable service has proved to be of value in estimating the degree of emotional illness of these men.

All of these men had severe emotional difficulties when examined at this institution, and of the total population about 3 percent were definitely psychotic. In view of these facts the value of confinement seems questionable unless a very intensive program of psychiatric treatment was possible during this period. Confinement alone appeared to make the man unfit for an adjustment in society because it increased the hostile-aggressive pattern followed from childhood.

The goal of confinement should be to prepare the prisoner psychologically for an adjustment in society rather than increase his hatred for all authority.

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**ADVENTURES AMONG VIRUSES: I. SOME PROPERTIES OF VIRUSES**, by Christopher Howard Andrews, F. R. S. *The New England Journal of Medicine* 242: 162-166, Feb. 2, 1950.

Of particular interest are the cases of virus persistence in the recovered vertebrate host. Indeed, one school of thought maintains that the enduring immunity that is a feature of many virus diseases can be attributed to the equally enduring persistence of virus in the host. It is true that many viruses can persist a long time, but there is no evidence that this is so whenever this life-long resistance is found. Psittacosis in birds is a good example of a virus disease in which infection is probably contracted in the nest, is commonly inapparent, persists indefinitely, and may become apparent when some jolt upsets the host-parasite balance.

The best example from human medicine is probably herpes simplex. Dodd, Johnston, and Buddingh showed that aphthous stomatitis in children is often due to the herpes virus. It is thus that many children doubtless become infected. Afterward the virus seems to persist in the epidermal cells about the mouth as a latent infection.

We have noted, in considering viruses of many kinds, how often a virus latently infects its host until a jolt to the virus-cell equilibrium brings about visible disease. We have seen how transmissibility of a virus, ability to infect other cells, is a varying property that may or may not be present. We have found that virus infection may begin *in utero* and possibly be transmitted even in the germ plasma. Finally, viruses are capable of great feats in the way of variation and adaptation, and they can also cause cell proliferation. We have, therefore, no grounds for maintaining that viruses cannot cause cancer because viruses do not have the qualities necessary to set the part. We need not find it difficult to believe in viruses that are almost ubiquitous, normally cause no visible disease, are transmitted in the earliest days of life and only in certain circumstances sustain a jolt that causes them to give rise to new growths. Bittner's virus of mammary cancer in mice has all these properties. Perhaps it is straining my metaphor to speak of a jolt in this instance, for the hormonal influences that lead to induction of cancer may well operate by permitting selection of a mutant of the ordinary latent form of the virus to a form that is highly pathogenic but extremely labile.—Abstract.



# Nutrition in Public Health in Japan<sup>1</sup>

PATRICK E. HOWE, Colonel, MSC, U. S. A.<sup>2</sup>

THE nutritional situation in Japan from January 1946 to December 1947 was similar to that in the liberated and occupied countries of Europe. The resources of the country had been used to support the activities of the Army, and the food of the civilian population had been officially restricted from the beginning of the war to approximately the basal metabolic level and had become so short that scientists were trying to determine how much farther the ration could be lowered without curtailing the ability of the people to support the Army. The people were apprehensive as to what the food situation might be under the occupation. Under such conditions, it was difficult to evaluate the reports as to the nutritional situation. The Supreme Commander Allied Powers (SCAP) wisely took action to determine the actual state of the nutrition of the people through (a) review of autopsy reports of persons dying in public places, (b) obtaining reports from the Ministry of Welfare of deaths caused by malnutrition, and (c) institution of nutrition surveys.

Remedial steps included reduction of the number of concentration camps to the minimum, care for the indigent by the Japanese Government, and the impounding and orderly distribution of surplus Japanese Army and Navy food and clothing, holding part of these supplies for emergencies. The immediate responsibility for the determination of the nutritional status of the people was placed on the Chief of the Public Health and Welfare Section and clearance was required between the sections of General Headquarters SCAP concerned with food to insure coordinated action. A consultant in nutrition was provided in the Public Health and Welfare Section for immediate supervision of the nutrition surveys and analysis of Japan's nutritional problems. The consultant traveled to some of the major cities for a personal

<sup>1</sup>This article continues a series of articles on nutrition published in The Bulletin of the U. S. Army Medical Department, March, April, and May 1949.

<sup>2</sup>Retired inactive.

\*Formerly nutrition consultant, Public Health and Welfare Section, General Headquarters, Supreme Commander Allied Powers. Publication authorized by that headquarters.

evaluation of the nutritional situation to obtain information from clinicians and Japanese health officials in order to determine where surveys should be conducted; he then organized the nutrition surveys.

The visible effects of under- or mal-nutrition take a long time to appear. The appearance of symptoms of nutritional deficiency in a community is evidence that either a particular food or food in general has been scarce or that proper care has not been given to the provision of an adequate diet. The only measure of inadequate diet prior to the appearance of symptoms is a review of the total food eaten daily. This involves a study of food habits and the availability of food. The medical phase of public nutrition is primarily diagnostic and advisory. Sound nutritional information forms the basis of decisions and advice. It is neither possible nor necessary to prescribe set food patterns since there are many ways to attain an adequate diet, although some food patterns are less likely to lead to difficulties than others. The quantity of food consumed is as important as the kinds of food, especially in judging simple diets in which large quantities of a particular food are eaten. Often it is possible to substitute one food for another; this is of importance in dealing with the poor.

The problems of the health officer in Military Government differ somewhat from those of other health officers. The latter works to improve the nutritional status of a community in order to prevent disease and to promote general health. The Military Government officer, on the other hand, often works in a community with a restricted food supply. The level set by higher authority is one that may merely prevent disease and unrest, or may permit reconstruction and production at restricted levels of food intake. Such low levels of nutrition are often outside the officer's previous experience. To make sound recommendations requires a careful analysis of the psychologic as well as the nutritional phases of the problem.

#### NUTRITION AND THE HEALTH OFFICER IN MILITARY GOVERNMENT

*General responsibilities.*—In view of the relationship of nutrition to the maintenance of health, and to diseases of endemic and epidemic character, the nutrition of the civilian population is of particular concern to the health officer in Military Government. His responsibility in the control and prevention of epidemic diseases and in the preservation of health directs his attention to nutritional deficiencies as an outstanding factor lowering the resistance of a population and predisposing to epidemics. Nutritional inadequacies, moreover, are likely to result in civil unrest and dissatisfaction prejudicial to the occupation. The medical officer acts in an advisory capacity to other officers in Military Government charged with the provision and distribution of food to civilians. The problems concern production, procurement,

distribution, and rationing of food, and indigenous food habits in relation to established nutritional allowances and rations. The health officer reviews the nutritional status of the civilian population and makes suitable recommendations to his commander and periodic reports to higher headquarters as directed.

The nutritional status of a population and the food available are assessed at various levels of reliability. The number of economic and psychologic factors involved in borderline cases require factual evidence and careful sifting of reports and rumors with regard to hunger, disease, and food supply in relation to normal conditions existing in the country and community and to basic nutritional requirements for sound long-range recommendations. Means of assessing the nutritional status of food intake include (a) observation of people on the street and of the foods available on the farms, in markets, and in stores; (b) analysis of the frequency and location of food thefts; (c) checks on such groups as infants, children, pregnant and nursing women, old people, patients in hospitals, and inmates of institutions; and (d) nutrition surveys.

Nutrition surveys include a survey of food consumption and physical examinations of the population and provide the best means of assessing the nutritional status of a population. Evidence of the nutritional status of the population indicates the types of food that need emphasis and the degree of emergency that exists in cases of general undernutrition. The kinds and amount of food consumed supply a basis for recommendation as to the kinds and amount of food required. Such data are required for action by the military authorities or the civilian population. Food consumption may be determined by (a) questioning persons as to the kinds and amount eaten in the last 3 meals and intermediate periods (this yields fairly good preliminary results when conducted by trained questioners), (b) having housewives keep records of the kinds and amount of food used in a given period; (c) placing observers in a home to weigh and record the kinds and amount of food used by the family or members of the family, (d) requiring that records be kept of the quantities of all food used in institutions and hospitals, and the number of persons actually eating the food; and (e) evaluating the result of consumption studies, made with tables of food composition. (All echelons concerned with the results should use the same tables or include a specific statement as to the tables used.)

The methods used in physical examinations may be simple or complex, but in general, the simple procedures are preferable. Symptoms and physical findings are rarely specific and diagnostic by themselves and should be supplemented by laboratory methods when feasible; however, symptoms and findings such as night blindness, typical skeletal changes associated with vitamin A and D

deficiencies, modifications of the skin and membranes of the mouth, and changes in nerve reaction and bradycardia in vitamin B complex deficiencies are reliable and diagnostic. Body weight in relation to standard height and weight for a given population is indicative of the extent of general undernutrition. Comparison of the incidence of symptoms from one survey to another and in relation to the usual rates together with consideration of the death rates and incidence of infectious diseases in the community are important in reaching a sound conclusion.

Prevention of dietary deficiency consists of the maintenance of normal nutrition in average persons by means of a natural diet, the components of which should be varied in order to insure qualitative adequacy. Health officers in Military Government should consider the availability and cost of foods and the dietary customs and habits of the people who are to consume them. Conclusions that dietary habits and customs exert an unfavorable influence on nutritional status should be made only after careful observation and consideration, since it has been shown that natural selection often results in adequate diets. Acceptable and adequate substitute foodstuffs should be available before questionable native food practices are discontinued, since as a rule food habits are deeply ingrained in the people. Not uncommonly, the deficiencies resulting from habit and custom are related to modern methods of processing and preservation. Thus, the use of highly milled and polished rice has produced a high incidence of beriberi in certain areas of the Orient, and in Japan has led to legislation regulating the milling of rice in order to preserve the antiberiberi factors in the grain.

Protection against nutritional inadequacy applies to particular groups of people who are especially susceptible to nutritional deficiency disease, such as infants, children, adolescents, pregnant and lactating women, the aged workers exposed to certain occupational hazards, and persons with diseases predisposing to nutritional deficiency. Circumstances may require the addition of special food supplements or chemical preparations to the diet of such groups. In general, natural foods and natural concentrates are to be preferred to chemical preparations.

The relief of dietary deficiency belongs to the realm of clinical medicine in all but the milder deficiency states that are amenable to simple dietary measures. These mild deficiencies should be relieved through an adequate natural diet. Severe deficiencies are specific medical problems to be treated medically as indicated, often with pure vitamins or chemical products. The basic principle of returning to a natural diet as soon as possible, however, applies even in florid cases, since such a diet prevents the recurrence of the deficiency and the appearance of other nutritional disorders.

Nutrition surveys in Japan were requested of the Japanese Government by a directive from SCAP<sup>4</sup> which provided that an officer of the Military Government, preferably a medical officer, review the conduct of surveys, especially with regard to the uniformity of the physical examinations.

The surveys were conducted under the general supervision of the Ministry of Welfare of the Japanese Government. The chief of the sanitary bureau of the city or prefecture was responsible for their conduct. The results of surveys were transmitted to the Ministry on completion.

Previous experience indicated the following difficulties in the conduct of the physical examinations: (a) Occasionally the scales were inaccurate—necessitating checking; (b) the quantity of clothing permitted in taking body weights has varied—necessitating establishing a standard for correction; (c) suitable devices for measuring height were usually but not always available; (d) the knee jerk was not determined by a uniform technique, and (e) examinations for hyperkeratosis were often perfunctory and confined to the upper shoulder and back of the neck, whereas in doubtful cases it is desirable to observe the back of the upper arms and legs.

Information on food consumption was obtained by requiring the housewife to record the kinds and amounts of food used in the household each day for 3 days. A nutritionist took the forms to each of the houses assigned to her on the day previous to the first day of record. The morning of the second day of record, she went to the house and checked the entries of the previous day. Samples of quantities of food used were sometimes kept by the housewife for verification of the weight by the nutritionist when there were no scales in the home. Standard weights of original and cooked food for given volumes were worked out and were used by the nutritionist. Daily visits were made to each house and the final sheet was collected on the day following the last day of recording.

Data on the quantities of food used per capita in hospitals were assembled each month in hospitals in Tokyo and later extended to other hospitals especially mental and tuberculosis hospitals, in other parts of Japan. It was recommended that similar data be obtained in penal and correctional institutions and homes for children and the aged, as part of the accounting of the institution. This "nutritional accounting" permits a rough evaluation of the adequacy of the food purchased, produced, and fed to the people living in the institution or home, and is an index of the effectiveness of the administrative control of the institution. Such reports combined with a basis of

<sup>4</sup> USMAGIN 4221, 11 December 1945, subject "Nutritional Surveys of Civilian Population" supplemented by Memorandum, dated 14 October 1946, subject "Information of General Application Pertaining to Directive Number SCAPIN 422."

rationing is an excellent basis for purchase and production of food when there is a farm attached to the institution. To facilitate review of the nutritive value of the food supplied, foods of similar kind and nutritive value or which are valuable for particular nutrients were classed together and the consumption per capita was calculated for the group. This reduced the number of items and permitted a ready nutritional review once the food pattern of the institution was known and evaluated.

*Rations for hospitals and institutions.*—Special allowances for the inmates of hospitals and institutions were recommended because of the difficulties such people have in obtaining additional food to supplement the inadequate ration. The recommendation included provision for nutritional accounting by institutions receiving extra food.

*School lunches.*—A proposal was discussed for the establishment of school lunches throughout Japan. The ideal school lunch not only

TABLE 1.—Food consumed per person per gram per day from nutrition surveys in Japan (Rice-year 1946-57)

	November 1946-August 1947			Indigenous total
	Urban	Rural	Total	
Grains:				
Rice	29.1	29.6	29.3	29.7
Wheat	25.5	21.3	24.2	25.5
Barley	21.3	23.1	21.7	21.3
Others	2.7	19.2	22.0	6.3
Total	294.5	279.4	279.5	271.1
Potatoes:				
Sweet	17.0	19.3	17.3	17.3
White	43.5	25.2	71.7	6
Others	15.2	21.7	21.9	
Total	251.9	211.1	211.1	
Nuts:				
Sugars:				
Oils:				
Legumes:				
Soya	2.4	3.7	3.0	
Soya products <sup>a</sup>	12.1	25.3	32.0	
Other beans	6.3	8.1	8.2	13.4
Animal foods:				
Fish	37.9	22.3	31.2	
Meat, poultry	8.1	7.8	7.8	
Eggs	1.5	2.2	1.8	
Milk	1.1	2.1	2.1	
Total	48.6	26.6	47.4	
Leafy green and yellow vegetables:				
	43.0	10.9	10.6	
Other fruits and vegetables:				
Citrus and tomatoes	16.4	12.2	12.5	
Other fruits	1.4	1.5	1.5	
Other vegetables	140.6	172.1	161.8	
Total	244.4	172.7	174.4	
Seaweeds:				
Processed vegetables:				
Dried	3.2	2.4	3.5	
Pickled	17.6	61.9	61.5	
Flavors:				
	23.4	16.5	16.9	

<sup>a</sup>All foods aside from those with figure + were legumes.

<sup>b</sup>About 21 percent were dried beans.

<sup>c</sup>Named various food chiefly dried peat.

Table 2.—Percent shortening during allusion formation

TABLE I Frequency weights of major groups of food remains (grams)

Flour	5.5													
Fried and pickled vegetables	6.1													
Flour, total	6.7													
Fat and oil, edible	20.7													
Fat, animal	1.613	1.367	1.973	1.884	1.822	1.717	1.970	1.912	1.912	1.917	1.917	1.917	1.917	1.917
Fat, plant	1.077	1.077	1.157	1.216	1.115	1.115	1.273	1.273	1.273	1.063	1.063	1.063	1.063	1.063
Fat, total	60.6	61.1	55.5	60.2	60.3	60.6	66.7	66.7	66.7	67.7	67.7	67.7	67.7	67.7
Fats, total	15.6	18.6	18.3	16.3	14.1	19.5	12.4	16.9	16.9	20.3	20.3	20.3	20.3	20.3
Fat, animal, protein	13.7	12.7	12.7	12.7	12.7	13.4	11.2	12.9	12.9	14.8	14.8	14.8	14.8	14.8
Fat, plant, protein	2.94	2.94	2.94	3.05	3.05	3.05	3.05	3.05	3.05	3.84	3.84	3.84	3.84	3.84

## RURAL (27 PREFECTURES)

Flour, total	463	470	470	467	445	461	459	459	459	414	414	414	414	414
(flour)	316	298	298	314	346	265	269	269	269	331	331	331	331	331
Flour, total	155	214	214	274	242	203	203	203	203	214	214	214	214	214
(wheat flour)	69	84	84	447	207	154	111	111	111	155	155	155	155	155
Fry, protein and cellulose	-	-	-	117	132	76	50	50	50	82	82	82	82	82
Fruit and vegetables	-	-	-	68	219	178	208	208	208	93	93	93	93	93
Legumes, dry	-	-	-	15.7	15.3	16.3	16.3	16.3	16.3	15.5	15.5	15.5	15.5	15.5
Animal fresh, total	-	-	-	23.8	26.7	32.3	25.6	25.6	25.6	17.0	17.0	17.0	17.0	17.0
(not fish).	-	-	-	7.7	9.3	5.1	3.7	3.7	3.7	31.4	31.4	31.4	31.4	31.4
Sweet	-	-	-	6.1	1.4	2.9	1.6	1.6	1.6	6.7	6.7	6.7	6.7	6.7
Dried and pickled vegetables	-	-	-	51.2	70.1	75.6	91.7	72.0	72.0	2.2	2.2	2.2	2.2	2.2
Fruit, total	-	-	-	2.022	1.978	2.350	2.165	2.032	2.032	2.014	2.014	2.014	2.014	2.014
Italian radishes	-	-	-	453	728	728	69	223	223	423	423	423	423	423
Protein, total	-	-	-	52.6	59.9	62.5	39.0	57.5	57.5	60.1	60.1	60.1	60.1	60.1
(animal protein)	-	-	-	4.8	6.9	5.4	5.7	6.1	6.1	7.2	7.2	7.2	7.2	7.2
Fat	-	-	-	12.9	12.2	11.0	10.4	11.1	11.1	11.0	11.0	11.0	11.0	11.0
Cathartichokes	-	-	-	393	391	441	116	422	422	414	414	414	414	414

provides food for the children, but includes foods that will correct the deficiencies of the food pattern of that particular region or city. The medical officer in military government should take an interest in the program when started and report their opinion of the effectiveness of the program.<sup>5</sup>

*Monthly or bimonthly reports.*—The health officer was to supply information for a monthly or bimonthly report from the military government team to which he was attached. Information with regard to the nutritional status of the civil population for which the team was responsible was part of the regular health report. The fields to be reviewed and covered when applicable were as follows: (a) The food resources available, separated into indigenous and imported food; (b) the official ration scale for persons in various categories; (c) the quantities of rationed food available to persons in various categories, including those in excess of the authorized allowance; (d) the extent to which food obtained was purchased or received in whole or in part as a free issue, including food served in soup or central kitchens, and canteens of Red Cross, Welfare Agencies, mines, and factories; (e) the vitamin concentrates or preparations and mineral salts issued by private or State agencies and the categories of persons to whom available and the basis of issue; and (f) evidence with regard to the state of health of the population as indicated by the trend of changes in body weight and data when available and signs and symptoms of nutritional deficiencies in relation to categories of persons.<sup>6</sup>

The results of the surveys were invaluable. They formed the basis for recommendations with regard to the need for and amount of imported food. Data characteristic of the nutritional situation in Japan are shown in tables 1, 2, and 3. The most significant observation was an increase in the prevalence of loss of knee jerk and of bradycardia in May and August, which takes place each year. This change is ascribed to the deterioration of the rice with a loss of thiamine on storage. A food shortage in a country is best reflected in the heights and weights of adolescent boys and girls. A decrease in heights began in 1941 and became greater as the war progressed. However, the rationing program did not affect the average heights of rural children nor of boys or girls of 18 to 21 years of age who had been on restricted diets.<sup>7</sup>

\* School lunches have been provided in Japan since December 1946.

\* NOTE.—Since December 1947 the methods of nutrition surveys have been revised and the areas of the surveys have been expanded.

<sup>7</sup> Howe, P. E., Growth of adolescent child as affected by restricted nutrition. In press.

# ROTC Training in an Army General Hospital<sup>1</sup>

HOWARD H. ANGELL, Major, MC, U. S. A.

THE postwar Medical Department ROTC program has now been in effect for 3 years. As has been customary for many years, students enrolled in this program in colleges of medicine have been required as part of the program to attend a 6-week, summer-camp session. Until the summer of 1949 the camp had been held at the Medical Field Service School exclusively. During the camp period, students participated in a field medical type training. In the spring of 1949, the Department of the Army inaugurated an entirely new concept in the summer-camp training program. Accordingly, all students enrolled in the advanced course who were veterans of World War II were permitted to attend a summer-camp program in one of the Army's teaching general hospitals. This article describes the program as it was conducted in one of the participating hospitals.

The camp was conducted in two sessions, one running from 13 June to 23 July; the other, from 1 August to 10 September. Students were received and processed the first day of the camp period. They were housed in separate barracks provided for them and were issued enlisted type uniforms and necessary equipment. In some respects the position of the student was somewhat anomalous; administratively their status was that of cadets, and hence enlisted men, while at the same time they were regarded as officers in their clinical work. Insofar as possible an attempt was made to administer these students on an officer-equivalent status. They were invited to make use of the facilities of the Officers' Club and to eat in the Officers' Mess.

From the standpoint of student training, summer camp was designed almost entirely to be clinical in nature. Purely military and field medical subjects were confined to a period equivalent to one-sixth of the course. At this hospital, the first week of each of the camp periods was spent in the essentially military and field medical type instruction, leaving the remaining 5 weeks for purely clinical

<sup>1</sup> Percy Jones General Hospital, Battle Creek, Mich.

training. Among the subjects presented in the first week were: (a) Safeguarding military information, (b) information and education, (c) medical records and reports, (d) leadership and courtesy, (e) military law, (f) hospital administration, (g) food service, and (h) organization of the Army and of the Medical Department.

#### TECHNIQUES AND METHODS OF TRAINING

The experience at this hospital indicated that the before-mentioned subjects had been presented previously to these veteran students. It therefore was necessary to present them in the form of review or refresher-type training courses.

At the beginning of the second week and for the remainder of the camp period, the students worked exclusively on the wards and in the clinics of the hospital. They were divided into groups of four or five each, with one of the members of the group appointed as group leader. The group leader was responsible for group discipline and for non-professional supervision of the members of his group. Each group was assigned to a specific ward in such a way that they spent 2½ weeks on medicine and its subspecialties and 2½ weeks on surgery and its subspecialties.

Individual students functioned as clinical clerks. An attempt was made to give the student this clinical clerkship-type of training without conflicting with or detracting from similar instructions given them during their academic year in their colleges of medicine. Under the supervision of ward officers and chiefs of services students took histories, conducted physical examinations, and followed patients by preparing progress notes. Cases were discussed by the ward officers and chiefs of services and the clinical impressions of the students were crystallized and constructively criticized by the ward officers and chiefs of services.

Those students that were assigned to surgical services had the opportunity to follow a patient from the time he was admitted to the hospital, through the diagnostic work-up, the operation, and the post-operative care. In various types of surgical cases, students acted as operative assistants.

On the medical service they were given the opportunity to engage in diagnostic procedures, such as electrocardiography and gastroscopy. Some students were assigned to the out-patient clinic and to the clinics of the various specialties where they rendered invaluable assistance and where they could see first how ambulatory patients are treated.

The regular hospital formal education program was made a part of the required instruction of the students. Lectures on special subjects by civilian consultants and staff members, as well as clinical-

pathologic conferences, tumor board meetings, roentgenologic conferences, and other specialized features of the hospital educational program were participated in and observed by all students. No training in obstetrics and gynecology was given.

Dental students were afforded the opportunity of rotating through the various sections of the dental service of the hospital. In addition, a formal program of lectures and conferences on dental subjects was presented by staff members and dental consultants.

The results of the program have been excellent, both from the standpoint of the student and of the Medical Department. At this installation a questionnaire was given to each student at the end of the camp session for his anonymous comment as to his reaction to the camp program. An overwhelming majority of students expressed the opinion that the camp period was well worth the time spent. They were of the opinion that the clinical material which they had observed, plus the opportunities for actual participation in patient care under supervision were extremely valuable to them. The formal training program of the hospital also received favorable comment. An interesting aspect of the camp period was the amount of interest engendered by the program in both Army internships and Regular Army careers. Evidence gathered by both questionnaire and interview showed conclusively that the students had been profoundly impressed with the quality of Army medicine and the teaching value of the Army internship program. About 75 percent of the students attending camp at this installation indicated their intention of applying for Army internships. This is in sharp contrast to the percentage of students interested in applying for internships in former years and can only be attributed to the interest engendered by the summer-camp program. The reactions of the students were gratifying and they are of particular importance to the procurement program.



baccalaureate degree in appropriate academic training, above average efficiency, and is serving in a rank that will permit him to be assigned at a relatively high level of responsibility, stands the best chance for selection, provided he does not exceed the age limit set forth in regulations. Age and rank factors can be waived, however, within reasonable limits if circumstances warrant. Plans are drawn for the student's duty assignments following graduation, and his career pattern is adjusted accordingly. In making the selections the maximum number of applications are desired, and officers who do not receive favorable consideration are encouraged to reapply in subsequent years. Usually applications are not held for automatic re-consideration. Fresh comments both from applicants and commanders are desired as well as up-to-date transcripts of recent academic activities, if any.

After the cases are prepared by the Personnel Division they are presented to the Professional Education Committee for decision. This committee is composed of professional consultants to the Surgeon General and representatives of the Personnel Division. Other divisions are represented when the proceedings concern them. For instance the Chief, Medical Service Corps, sits on the committee when a member of his corps is being considered. The Chairman is the Chief, Education and Training Division. When all applicants have been considered the Personnel Division and the interested consultant both present recommendations on each case and a decision is reached. Acting on this decision, the Education and Training Division arranges for contracts with the schools to furnish the training and the Personnel Division issues the necessary orders, provides needed replacements for selected officers, and returns applications on which unfavorable action was taken. Funds in a limited amount are also available for courses of 12 weeks' duration or less. Usually these courses are not announced. Each application is considered when it is received and judged on its merits. The institution to give either the long or short courses can be selected by the applicant subject to concurrence by the committee.

Q. Is career management applicable in local assignment policies for administrative officers?

A. Yes. When a junior administrative officer goes to a duty assignment for a 3- or 4-year tour of duty, the commanding officer and the members of his personnel staff should plan duty assignments during this tour that will give the officer the broadest possible experience in the activities conducted at that installation. These assignments must be planned locally so as not to interfere with the activities of other officers and the mission of the command. A company-grade officer should rarely remain on the same assignment for the entire tour of

duty. Local career management will determine the success or failure of the program. Local training programs for officers can often supplement and, in some instances, obviate a certain amount of rotation. In any event, they should be an important part of local career management activities. A small number of junior administrative officers will be allowed to specialize but this group will include only those who qualify for positions that require a high degree of technical training in such fields as budget, atomic energy, legislation, and liaison.

When a senior administrative officer is assigned to an installation, it is usually intended that he fill a specific job that is in keeping with his primary MOS. In this case he should not be moved to another type of duty during his tour without concurrence of the Career Management Branch, Office of the Surgeon General.

**Q.** Should an administrative officer specialize in filling positions such as adjutant, mess officer, personnel officer, or supply officer?

**A.** No. Junior officers who specialize in such positions only hurt their future. As they advance in grade, they should enter broad fields of administrative specialization such as hospital administration, supply, and training, but they should seldom be assigned repeatedly to one type of position. Company-grade officers should also expect assignment to all types of units such as medical battalions; hospitals, both field and fixed; training centers; and Organized Reserve Corps units to give them a broad background in all Medical Department activities.

**Q.** Does constructive credit for a service school serve as a bar to attendance at that school?

**A.** No. Since the basis for credit was seldom the equivalent in training benefits to the material that could have been had by actual attendance, such attendance is encouraged.

**Q.** What is the authorized and actual strength of the Regular Army Medical Service Corps by grade?

**A.** This is shown in table I.

TABLE I.—*Grades of officers in Medical Service Corps*

Grade	Regular Army authorized strength	Regular Army actual strength		Reserve grade in which serving
		Permanent grade	Grade in which serving	
Colonel . . . . .	17	2	13	2
Lieutenant colonel . . . . .	116	50	45	51
Major . . . . .	156	113	100	247
Captain . . . . .	191	281	221	153
First lieutenant . . . . .	156	91	69	73
Second lieutenant . . . . .	20	13	9	29
Total . . . . .	832	588	588	2,157

**Q.** How many vacancies for appointment in Regular Army Medical Service Corps exist in each of the four sections?

**A.** This is shown in table 2. The break-down is not established by law and is readily adjustable as estimated requirements change. Overstrengths in one section can be applied against vacancies in another until adjusted by attrition. Appointments now can be made only in the grade of second lieutenant (or first lieutenant with Ph. D. degree). Necessary information and qualifications for appointment are contained in SR 605-25-10, 21 December 1949.

TABLE 2.—Vacancies in Medical Service Corps by section

Section	Authorized	Actual	Vacancies
Pharmacy, supply and administration	510	499	11
Sanitary engineering	55	11	44
Optometry	17	1	16
Allied sciences	240	77	173
Total	822	586	710

**Q.** How many Medical Service Corps officers will be sent to Army Service Schools during the calendar year 1950?

**A.** This is shown in table 3.

TABLE 3.—Estimated number of Medical Service Corps officers to be sent to service schools

Armed Forces Staff College	1	St. Louis Medical Depot	1
Command and General Staff College	3	Medical equipment maintenance	2
Medical Field Service School	3	Opticians	1
Advanced branch course	45	Radiologic defense	5
Basic branch course	10	Quartermaster School	5
Hospital administration	50	Army Information School	1
Associate advanced branch course	10	Total	115
Associate basic branch course	5		

<sup>1</sup> Given at the Army Chemical Center and elsewhere.

**Q.** How many Regular Army Medical Service Corps officers do you estimate will be in civilian institutions for training during calendar year 1950?

**A.** This is shown in table 4.

TABLE 4.—Estimated number of Regular Army Medical Service Corps officers to be sent to civilian institutions

Hospital administration	1	Clinical psychology	8
Personnel management	1	Psychiatric social work	4
Business administration	2	Radiologic defense engineering	1
Parasitology	1	Pharmacology	4
Biochemistry	1	Radiodontology	1
Physical reconditioning	2	Training in Industry	2
Bacteriology	2	Radiochemistry	1
Sanitary engineering	1	Total	33
Microbiology	1		

"OBSERVE ALWAYS THAT EVERYTHING IS THE RESULT OF A CHANGE, AND GET USED TO THINKING THAT THERE IS NOTHING NATURE LOVES SO WELL AS TO CHANGE EXISTING FORMS TO MAKE NEW ONES LIKE THEM."—*Marcus Aurelius Antoninus*

## EDITORIAL

### Resistance and Dependence of Bacteria to Antibiotics

The observation that certain strains of bacteria may become not only resistant to streptomycin, but also dependent upon the drug for growth was reported by Miller and Bohnhoff (1) (2) (3) (4) of the University of Chicago in 1947. This startling phenomenon has captivated the interest of scientists and physicians because of its practical and scientific interest. Of particular interest has been the continued investigation of the problem by Dr. Miller and his associates under the Office of Naval Research that has supported this research since 1946.

In the first report, Miller and Bohnhoff (1) state: "In an attempt to explain the rapidity with which meningococci develop a very high degree of streptomycin resistance during two or three subcultivations on media containing increasing concentrations of the drug, certain observations were made." Normal meningococcus colonies developed on media containing 10 to 20 micrograms of streptomycin per milliliter, but were absent on media having concentrations of 40 micrograms per milliliter. On higher concentrations of the drug, two unusual types of meningococcus colonies developed. The type designated as "A" variant appeared to be an ordinary streptomycin-resistant strain, but the type "B" variant is the one that made history.

In culture, "B" variants are small and pearl-gray when the medium contains from 60 to 100 micrograms of streptomycin per milliliter. On higher concentrations, the colonies are larger and have a yellowish tinge resembling "A" variant. This indicates that the concentration of the drug has a direct effect upon the cell physiology. The action is reversible, depending upon the concentration of the drug in the medium. These variants require streptomycin for growth in vitro and the number of colonies developing from equivalent inocula are always greatest when the concentration of drug in the medium is between 100 and 400 micrograms per milliliter.

This variant is not virulent for mice, but when mice are inoculated with the "avirulent" strain and "treated" with streptomycin (500 to 5,000 micrograms) they develop fatal meningococcal sepsis. Meningococci were recovered from heart blood cultures of the dead mice with

regularity when the cultures were made on streptomycin-containing media. Duplicate cultures plated on streptomycin-free media were sterile.

The investigators conclude, after thorough study, that this streptomycin-dependent strain is a current mutation. Reversion to "normal" or non-streptomycin-dependent type is so rare as to represent the exception that proves the rule.

Subsequent observations (5) (6) have yielded considerable information on the problem of resistance and dependence.

Rabbits and mice were treated with streptomycin. Cultures were made from their upper respiratory and intestinal tracts. During the second week of treatment, streptomycin-dependent bacteria belonging to species normally inhabiting the respective areas were recovered.

Throat smears from patients under treatment with streptomycin (receiving more than 1 gram of the drug daily) were examined for drug-resistant strains (7). During the first 13 days of treatment 98 percent of the patients were found to have streptomycin-resistant bacteria belonging to the normal flora of the human throat. It was reported that streptomycin-dependent strains were also recovered, but details are not given.

From these two series of tests, it is to be concluded that streptomycin-dependent bacteria actually occur in nature.

It is curious that in the most exacting streptomycin-dependent cultures, streptomycin is not utilized by the growth of the organisms (8).

Extension of studies to other micro-organisms has revealed that resistant and dependent variants occur in cultures of *Staphylococcus*, *Bacillus proteus*, *Escherichia coli*, *Aerobacter aerogenes*, and *Salmonella*.

Studies currently under way are designed to determine how common resistance and dependency may be to other antibiotics. Two strains of meningococci have been found to "grow better" in the presence of penicillin. They "require" penicillin, however, only in the absence of certain growth-stimulating factors, such as whole blood in the media or high carbon dioxide concentration in the atmosphere.

Strains of *Escherichia coli* have been isolated that are resistant to penicillin, chloramphenicol, and bacitracin, and to combinations of these drugs with streptomycin and themselves.

The importance of these observations is difficult to evaluate. Perhaps it is not surprising that such mutants occur in nature. Proof that they do, leads to some interesting speculations regarding the future of therapeutics and even epidemiology (9). The fact that antibiotic therapy, especially with penicillin and streptomycin, has given and continues to produce satisfactory results indicates that the phenomenon must not be too common or of too great significance.

This does not mean to infer that the clinician should fail to realize that such mutations do occur and may give rise to unpleasant results. The significance may be more far-reaching than can be visualized at present.—*Roger D. Reid, Ph. D., Office of Naval Research, Washington, D. C.*

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9. MILLER, C. P.: Occurrence of streptomycin-resistant and dependent bacteria in throats of patients treated with streptomycin. *Tr. A. Am. Physician* 61: 335, 1948.



## BOOK REVIEWS AND BOOKS RECEIVED

Publishers submitting books for review are requested to address them as follows

The Editor,

UNITED STATES ARMED FORCES MEDICAL JOURNAL,

Bureau of Medicine and Surgery, Navy Department,  
Washington 25, D. C.

(For review)

**EXPERIMENTAL SURGERY including Surgical Physiology** by J. Markowitz M. B. E., M. B. (Tor.) Ph. D. M. & in Exp. Surg. (Minn.), Associate Professor of Physiology, University of Toronto, Formerly Assistant in Division of Experimental Surgery and Pathology Mayo Foundation Rochester Minn. 2d edition 546 pages Illustrated. The Williams & Wilkins Co. Baltimore Md. publishers, 1949 Price \$7

The author emphasizes that our knowledge of the physiologic activity of the various organs is largely based on experimental surgery performed on animals and further that many of the remarkable advances made in surgery and a great deal of the knowledge concerning the function of the glands of internal secretion are the direct results of this kind of surgery.

This book contains a wealth of information relating to surgical physiology and experimental surgical procedures and technique covering practically every organ in the body, and also includes blood vessel surgery and surgery of the nervous system.

The free style and discursive and coordinated presentation makes this book extremely interesting reading. It is recommended for the intern and resident in surgery as well as for the surgeon and internist, they will find in it many practical facts of great clinical value—*Capt. J. L. Schwartz, (MC) U. S. A.*

**MUSCLE TESTING AND FUNCTION** by Henry O. Kendall and Florence P. Kendall. Physical Therapy Department Children's Hospital School, Baltimore Md. with a foreword by George E. Bennett, M. D. Emeritus Adjunct Professor of Orthopedic Surgery and Robert W. Johnson, M. D. Adjunct Professor of Orthopedic Surgery, Johns Hopkins Medical School Baltimore, Md. 274 pages with 102 illustrations. The Williams & Wilkins Co. Baltimore, Md. publishers 1949 Price \$7.50

This book describes the procedures in testing, grading, and recording muscle strength. The functional significance of muscle weakness and contracture is discussed in detail. The records obtained from these tests provide a basis upon which the physician can prescribe muscle reeducation and upon which he can rely for pertinent information if it is necessary to plan reconstruction orthopedic surgery.

As a background for this book, muscle testing was performed on several thousand patients, both paralytic and nonparalytic, by the authors during 25 years.

experience in physical therapy. In addition, for the purpose of research, tests and postural examinations were done on approximately 1,000 normal persons.

The first chapter presents the general procedures and fundamental principles in manual muscle testing and grading. Definitions of the terms used are included.

Chapter 2 illustrates four types of charts used in recording muscle examinations: diagnostic charts for nerve lesions, cranial nerve chart, polymyelitis charts, and body mechanics chart. The diagnostic charts for the nerve are new and extremely valuable, and have been designed especially for use in lesions of the spinal nerves.

The remaining chapters consist of specific test procedures. Photographs and anatomical drawings are included with the tests to show the muscle, the direction of movement, and to indicate the place and direction of the examiner's pressure. The accompanying text gives detailed information on the test.

The appendix lists muscles grouped according to joint action and gives their origins and insertions.

Physical therapists will find this book a valuable aid in teaching and a useful reference.—Lt. R. Moeller, (NC) U. S. N.

**THE PATHOLOGY OF NUTRITIONAL DISEASE, Physiological and Morphological Changes Which Result From Deficiencies of the Essential Elements, Amino Acids, Vitamins, and Fatty Acids.** by Richard H. Follett, Jr., M. D., Associate Professor of Pathology, Duke University School of Medicine, Durham, N. C. 291 pages, Illustrated. Charles C Thomas, Springfield, Ill., publishers, 1948. Price \$6.75.

The reader of this treatise on the pathology of nutritional disease will find a complete discussion of the currently available information which deals with the physiological and morphological changes occurring naturally or produced experimentally, which accompany deficiencies of one or more of the forty-eight nutrients now known to be essential. Among the nutritional deficiencies discussed are scurvy, the anemia of iron deficiency, rickets, beriberi, pellagra, and edematous goiter.

Especially significant is the chapter on choline, which is an important constituent of the phospholipid lecithin. The role played by choline in either of the liver has been omitted; however, the relationship between choline and fatty metamorphosis is well presented and more recent developments are adequately discussed.

This excellent textbook is to be recommended to students of pathology and biochemistry, as well as workers in nutrition and other fields.

—Lieutenant Commander K. P. Knutson (M) U. S. N.

**NUTRITION AND PHYSICAL FITNESS,** by L. Jean Bogert, Ph. D. Formerly Instructor in the Department of Medicine, University of Chicago; Instructor in Experimental Medicine, Yale Medical School, and Lecturer in Chemistry, Connecticut Training School for Nurses, New Haven; Professor of Food Economics and Nutrition, Kansas State Agricultural College, Manhattan; Research Chemist, Maternal Department, Henry Ford Hospital, Detroit. 5th edition. 610 pages, 35 tables and 103 figures. W. B. Saunders Co., Philadelphia, Pa., publishers, 1939. Price \$1.50.

This is the fifth edition of a text on nutrition which made its first appearance in 1931. The book is intended for those interested in home economics. The author assumes that the reader has no previous knowledge of physiology, chemistry, or nutrition. The aim of the book is to present the "particular facts which anyone needs to know in order to build a sound body and maintain a high degree of health and vigor."

The book is divided into five parts, namely: Foods, Body Needs, Body Processes, Meal Planning, and Diet for Special Conditions.

In covering this material in a small text, the author necessarily had to limit herself to dogmatic statements and present those which she considered the con-

**THERAPY THROUGH INTERVIEW**, by Stanley G. Law, M.D., Minnesota Psychiatric Institute, Foreword by Eric Kent Clarke, M.D., Minnesota Psychiatric Institute, Minneapolis, Minn. 305 pages. McGraw-Hill Book Co., Inc., New York, N.Y., publishers, 1948. Price \$4.50.

This would be a very amusing book if it were written for that purpose. But since it is apparently intended as a serious book on therapy it is far from entertaining. It is true that the author states that it is not intended to create psychiatrists from general practitioners and that fault may be found with its oversimplification but he seems to lose sight of these facts after the first few pages. The naive reader who looks for clear-cut cases in actual practice will be sadly disappointed by the use of fictional cases in which the therapeutic situation is presented in question and answer form. These fictional cases create an unrealistic impression. In the opinion of the reviewer, the author has missed the type of case in which his intended audience i.e., the general practitioner, is most likely to be interested. He discusses, for example, the therapy of peptic ulcer, the psychopath, and sexual perversions that more experienced psychiatrists might approach with misgivings but does not mention the handling of anxiety, fatigue, or the somatic manifestations of depressions which are a frequent source of complexity to the general practitioner.

The insistence of the author on the distinction between psychiatry and medicine should be clarified. It would seem that attempts to divorce psychiatry from the rest of the practice of medicine should be deprecated rather than encouraged. Psychiatry is only one branch of the practice of medicine and psychotherapy is only a specialized form of general therapeutics.

Although this book can hardly be recommended for the general practitioner who may be misled by its oversimplification it should prove entertaining to the psychiatrically oriented reader—Commander J. R. Cavanagh (MC) U. S. N.

#### BOOKS RECEIVED

Receipt of the following book is acknowledged. As far as practicable, it will be reviewed at a later date.

**MODERN FOOT THERAPY**, by Reuben H. Gross, M.C., Prof. D. Dean and Chairman, Department of Podiatry, the First Institute of Podiatry, Long Island University, New York with the collaboration of 19. Edited by Maurice J. Lent, M.D., President, and Director of Instruction, the First Institute of Podiatry, Long Island University. Modern Foot Therapy Publishing Co., New York, N.Y., publishers, 1948. Price \$9.50.

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*The Journal is indexed in  
the following publications:*

*Current List of Medical Literature*

(Army Medical Library) Weekly listings of journal contents by author, subject index monthly.

*Quarterly Cumulative Index Medicus*

(American Medical Association) Author and subject.

*Index-Catalogue of the Library of the Surgeon General's Office, U. S. Army*

(Army Medical Library) Now in Fourth Series, Vol. X, Letter M (first half). Author and subject.

## Foreword

The UNITED STATES ARMED FORCES MEDICAL JOURNAL represents the unification of the BULLETIN OF THE UNITED STATES ARMY MEDICAL DEPARTMENT, published since 1922, and the UNITED STATES NAVAL MEDICAL BULLETIN, published since 1907. This joint periodical is the medium for disseminating information of administrative and professional interest to all medical personnel of the Department of Defense.

It is the aim to include in each issue administrative directives, original scientific and professional articles, editorial comments on current professional literature of special interest, clinical notes, descriptions of new devices and instruments, abstracts of articles from various medical periodicals, and notices and reviews of newly published professional books, of interest to all commissioned medical personnel of the Department of Defense.

The Director, Medical Services, and the Surgeons General of the several services extend an invitation to all medical officers, dental officers, Medical Service Corps officers, Nurse Corps officers, officers of the Veterinary Corps, all officers of the ancillary services of the medical services of the Armed Forces, and to the medical consultants of the Army, Navy, and Air Force to submit manuscripts for publication in this JOURNAL.

RICHARD L. MEILING, M. D.,  
*Director, Medical Services,  
Department of Defense.*

RAYMOND W. BLISS,  
*Major General, U. S. A.,  
Surgeon General, U. S. Army.*

CLIFFORD A. SWANSON,  
*Rear Admiral (MC) U. S. N.,  
Surgeon General, U. S. Navy.*

HARRY G. ARMSTRONG,  
*Major General, U. S. A. F.,  
Surgeon General, U. S. Air Force.*

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UNITED STATES  
GOVERNMENT PRINTING OFFICE  
WASHINGTON 1950

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F. W. FARRAR, *Editor in Chief,*

Captain, Medical Corps.

United States Navy

WAYNE G. BRANDSTADT, *Associate Editor,*

Colonel, Medical Corps.

United States Army

ALFRED A. GENTILCORE, *Associate Editor*

Captain, Medical Service Corps.

United States Air Force

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DEPARTMENT OF THE NAVY  
BUREAU OF MEDICINE AND SURGERY  
WASHINGTON 25 D. C.

IN REPLY REFER TO

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Armed Forces

The April, 1950 issue of the U S Armed Forces Medical Journal reported the first step in achieving uniform classification, nomenclature and definitions of medical treatment facilities in the Armed Forces. That directive, promulgated by the Secretary of Defense on 27 January 1950, provided for uniform terms and definitions for bed capacity and bed spaces of fixed medical treatment facilities.

This standardization program was further advanced on 27 April 1950 with the issuance of two additional directives. The first provided a classification of and definitions for the fixed treatment facilities, i.e., dispensaries, infirmaries and hospitals. The second specified standard terms and definitions for bed capacity and bed spaces in non-fixed medical installations, such as mobile surgical hospitals, dispensaries operated as "organic" parts of tactical units, sick bays aboard ship, etc.

This program, developed by a Task Force of medical officers of the three services, is a significant part of the broad program of the military medical services, for it provides the framework on which interservice cooperation can be greatly strengthened and medical care facilities used to maximum advantage.

*Richard L. Melting*

Richard L. Melting, M.D.  
Director of Medical Services



# UNITED STATES ARMED FORCES MEDICAL JOURNAL

*Published monthly by the Department of Defense*

T. W. FARRAR, *Captain (MC) U.S.N.*, Editor in Chief  
 WAYNE G. BRANDSTADT, *Colonel, MC, U.S.A.*, Associate Editor  
 ALFRED A. GENTILCORE, *U.S.A.F. (MSC)*, Associate Editor



THE PRINTING OF THIS PUBLICATION HAS BEEN APPROVED BY THE DIRECTOR OF THE BUREAU OF THE BUDGET, OCTOBER 19, 1949

## Tumors of the Testes

### Five-year Follow-up Study

HIGH V. O'CONNELL, *Commander (MC) U.S.N.<sup>1</sup>*  
 CHARLES P. GESCHICKTER, *Commander (MC) U.S.N.R.<sup>2</sup>*

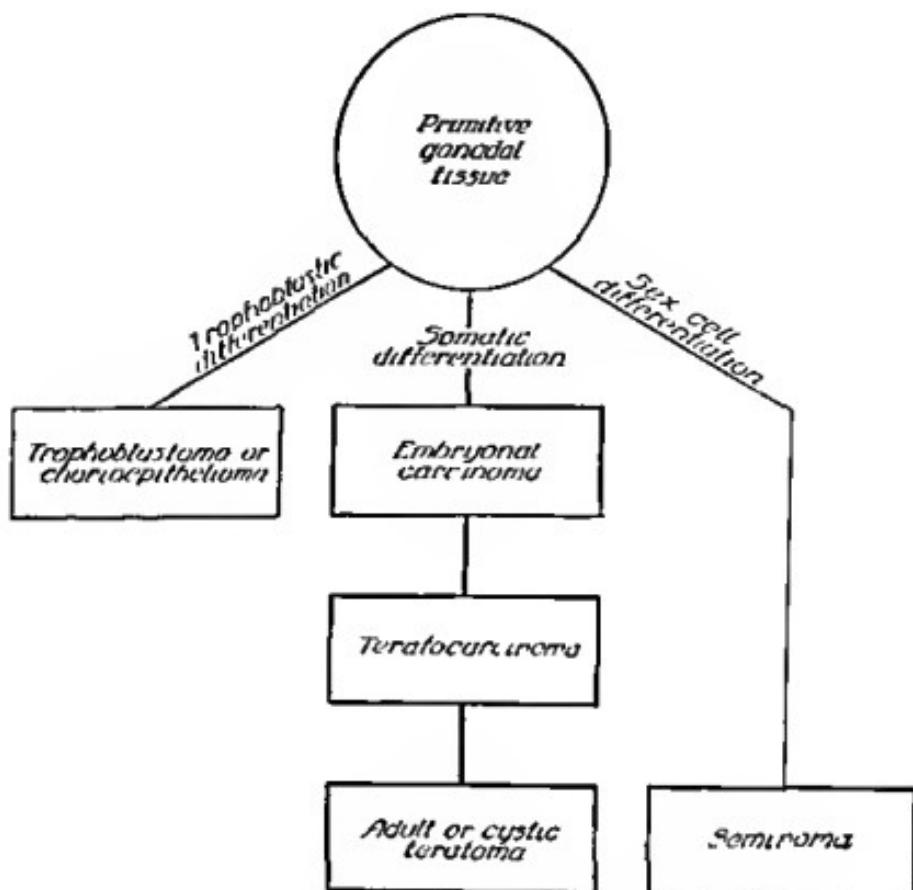
ALTHOUGH malignant tumors of the testicle are relatively rare, these neoplasms pose a particularly serious problem to military medicine. They occur in the third and fourth decades of life during the period of maximum productivity; the incidence is at its peak in the late twenties. Among Army personnel the incidence was found to be about 1 in 10,000; we found a similar incidence among Navy personnel.

#### HISTOGENESIS

Because the variety of histologic types of testicular tumors indicates that germinal tissue or gonocytic cells provide the origin for these new growths, one can theorize that the developmental potentialities of this tissue corresponds to the pathway of differentiation followed by the fertilized sex cell. The tissue of origin is totipotential and is capable of developing along lines similar to those found in the earliest phases of differentiation in the fertilized ovum or zygote. As shown in figure 1, the fertilized ovum pursues three separate lines of development. The earliest to be completed is trophoblastic differentiation which

<sup>1</sup> Department of Pathology, U.S. Naval Medical School, National Naval Medical Center, Bethesda, Md.

<sup>2</sup> Professor of Pathology, Georgetown University School of Medicine, Washington, D.C.; Consultant in Pathology, U.S. Naval Medical School, National Naval Medical Center, Bethesda, Md.



*Figure 1.—Theory of histogenesis of testicular tumors.*

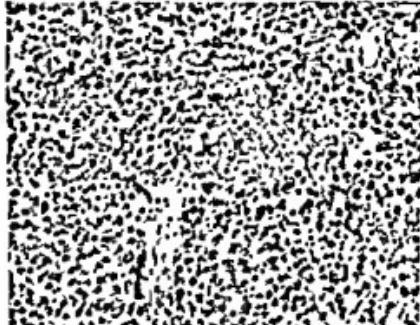
forms placental tissue. Trophoblastic differentiation is represented among testicular tumors by choriocarcinoma or trophoblastomas. The second line of differentiation is concerned with embryogenesis and consists of the elaboration of the three germ layers. This is represented among testicular tumors by embryonal carcinoma, teratocarcinoma, and adult teratomas. The third line of development is concerned with the formation of reproductive tissue for subsequent generations and for the perpetuation of gonocytic tissue and is represented among testicular tumors by the seminomas.

#### HISTOPATHOLOGY

Following the lead of Ewing (1) in 1911 the trend in pathology was to disregard the histologic subclassification of malignant neoplasms of the testicle and to group them as malignant embryomas or teratomas, chiefly because an admixture of cell types could be demonstrated in a given case. In 1931, however, Ferguson et al. (2), studying the hormonal output of the urine in patients with testicular tumor, re-emphasized the desirability of subdividing these malignant growths.



*Figure 2.—Gross specimen of testicular seminoma. The cut surface of the tumor is granular and resembles somewhat the normal testis.*



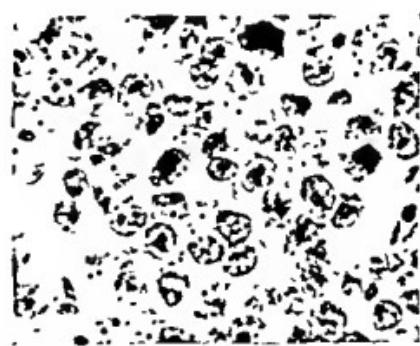
*Figure 3.—Low-power photomicrograph of seminoma. The cellular components stand out individually and are embedded in lymphoid stroma.  $\times 100$ .*

There is now a general agreement that the behavior and prognosis differ for teratomas, seminomas, and embryonal carcinomas—the most common types of testicular malignancy.

Seminoma is usually a slow-growing testicular mass. The history of swelling of the testicle may date back as long as 5 years; the average is 14.5 months. Grossly it is a granular, fleshy, yellow mass resembling the neighboring testicular tissue (fig. 2). Microscopically it is composed of rather uniform rounded to polyhedral cells occurring in large sheets. The cells have a distinct border, a centrally placed vesicular nucleus, and usually a distinct nucleolus. The cytoplasm is clear, taking a faintly eosinophilic stain with hematoxylin and eosin. In many instances a lymphocytic infiltrate is scattered throughout the tumor areas (figs. 3, 4, and 5).



*Figure 4.—Medium-power photomicrograph of seminoma. The nuclei and cytoplasm are of moderate size with an occasional large nucleus.  $\times 200$ .*



*Figure 5.—High-power photomicrograph of seminoma. The nuclear patterns resemble those seen in embryonal carcinoma (fig. 12). The cytoplasm is granular and has indefinite borders. There is no attempt at alveolar formation.  $\times 400$ .*

Adult teratoma and teratocarcinoma are solid or cystic testicular tumors which at times may seem to contain fluid on palpation depending upon the size of the cystic areas (fig. 6). In our cases, the history of a swelling of the testicle dated back 4 to 5 months. The adult type neoplasm grossly is well-circumscribed with a definite capsule separating the neoplasms from the surrounding testicular tissue. Microscopically, they are made up of a variety of structures with adult epithelium, cartilage, and smooth muscle predominating (figs. 7 and



*Figure 6.—Gross specimen of cystic teratoma of testis. The cystic components of the tumor bulge from its cut surface. The white fibrous structure of the neoplasm is clearly demarcated.*



*Figure 7.—Adult testicular teratoma showing the dense fibrous stroma and a cyst lined by low columnar epithelium.  $\times 50$ .*



*Figure 8.—Adult testicular teratoma showing the characteristic primitive fibromuscular stroma, islands of hyaline cartilage, and cysts lined with ciliated epithelium.  $\times 100$ .*



*Figure 9.—Testicular teratocarcinoma. This pleomorphic tumor contains islands of squamous epithelium and mucinous glands embedded in cellular fibrous stroma.  $\times 100$ .*

b). Occasionally neurogenic tissue, osseous and various glandular components may be encountered. In general, the adult teratomas present histologic features in one or more areas that resemble those found in teratocarcinoma. The teratocarcinoma grossly resembles the

adult type but, in addition, areas of necrosis and hemorrhage are usually seen. Microscopically, all the elements present in the adult teratoma may be present but the individual elements, particularly the epithelium, take on malignant characteristics (figs. 9 and 10). Areas of chorionic tissue and embryonal carcinoma may be a conspicuous feature. In the final analysis the subclassification of teratomas into adult



Figure 10.—Medium-power photomicrograph of the teratocarcinoma shown in figure 9.  $\times 200$ .



Figure 11.—Testicular embryonal carcinoma. The tumor is forming alveolar spaces surrounded by cells of varying shapes and sizes, containing irregular hyperchromatic nuclei.  $\times 100$ .

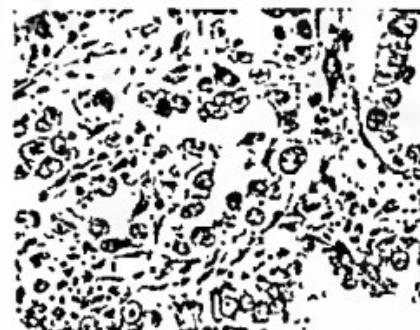


Figure 12.—High-power photomicrograph of embryonal carcinoma shown in figure 11. The alveolar pattern is clearly shown.  $\times 400$ .

and carcinomatous forms is of doubtful value. In our opinion both groups are malignant, the degree of malignancy varying with the amount of chorionic and embryonic tissue present. The embryonic tissue usually takes the form of embryonal carcinoma or neuroepithelioma.

Embryonal carcinoma forms a solid, rapidly growing mass which may be complicated by hemorrhage and tenderness. In our cases the duration of symptoms prior to examination was approximately 7 months. Grossly this carcinoma is a soft, necrotic, or hemorrhagic tumor mass ill-defined from the surrounding tissue. Microscopically it is composed of large epithelial cells occurring in a variety of cellular and acinar patterns. Occasionally the cells may be of uniform size and appearance, but more frequently there is considerable pleomorphism. The cells are larger than the cell making up the seminoma and vary in appearance from cuboidal to polyhedral. The nuclei are large and hyperchromatic (figs. 11 and 12). In this type,

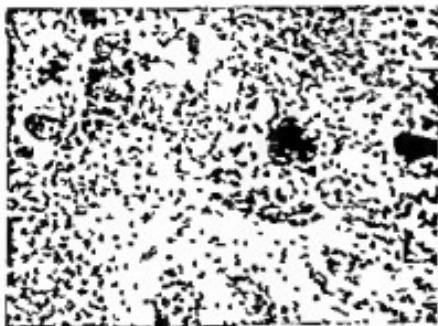


Figure 13.—Testicular chorioepithelioma or trophoblastoma. Characteristic islands of syncytial cells adjacent to vascular spaces. Sheets of cytotrophoblasts are also present.  $\times 100$

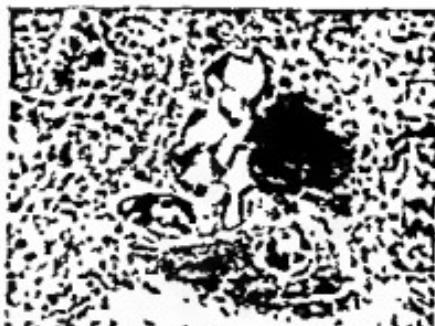


Figure 14.—Testicular chorioepithelioma. Same as figure 13.  $\times 300$

large bizarre cells representing the remnants of trophoblastic tissue are frequently encountered.

Chorioepithelioma of the testicle in pure form is rare, and signs of metastases associated with a positive Aschheim-Zondek test may precede the discovery of the primary mass. The surgical specimen shows soft, hemorrhagic, ill-defined neoplastic masses occupying a small portion of the testis. Microscopically the picture is characteristic (figs. 13 and 14). Two cell types are usually present, the large irregular hyperchromatic syncytiotrophoblast and the more regular, oval or cuboidal cytotrophoblast. In most areas there is no cell pattern but in some instances there are attempts at formation of typical chorionic villi. Hemorrhage is a prominent microscopic feature.

The mortality rate from these neoplasms has always been considered to be extremely high; however, no adequate studies of a large series of cases have been reported prior to the last war. In 1946 Friedman and Moore (3) reported 922 cases of testicular tumors observed for a period up to 1 year. During that period the mortality rates for this group were 27.5 percent for embryonal carcinoma, 17 percent for teratocarcinoma, 15 percent for teratoma, and 2.5 percent for seminoma. In 1947 Gordon-Taylor and Wyndham (4) reported 636 cases of testicular tumors; 38 percent of the patients were dead within 1 year and 55.5 percent within 5 years. The death rate in individual types of testicular tumors was not given, nor were the details of the follow-up data on which their conclusions were based. Lloyd Lewis (5) in 1948 reported that 24 percent of 169 patients with all types of testicular tumors treated between May 1942 and July 1946 by radical orchectomy were dead at the end of approximately a year and a half.

Recently Sauer and Burke (6) reported that the over-all cure rate in their series, based upon a review of 202 cases of testicular tumor admitted over a 25-year period (1 January 1922 to 31 December 1946)

was 47.5 percent. The 5-year cure rate was 48.9 percent in 143 patients admitted prior to 31 December 1941. The cure rates for the various types were as follows: adult teratoma, 80.0 percent; seminoma, 59.6 percent; teratocarcinoma, 41.4 percent; and embryonal carcinoma, 22.5 percent.

#### CLASSIFICATION

This study is based upon 229 cases of testicular tumors, 216 of which fall into the classification of either seminoma, teratoma, or embryonal carcinoma. Of the 216 cases, 162 had been observed a minimum of 5 years or until death (table 1); 12 cases of miscellaneous tumors had been observed a comparable length of time. Only those cases in which microscopic study permitted classification of pathologic type and in which there was adequate follow-up data have been included. We found that the percentage distribution for the various types is comparable to that of Friedman and Moore (3) who studied a much larger group and that seminoma, teratoma, and embryonal carcinoma occurred with about equal frequency among 229 cases (fig. 15).

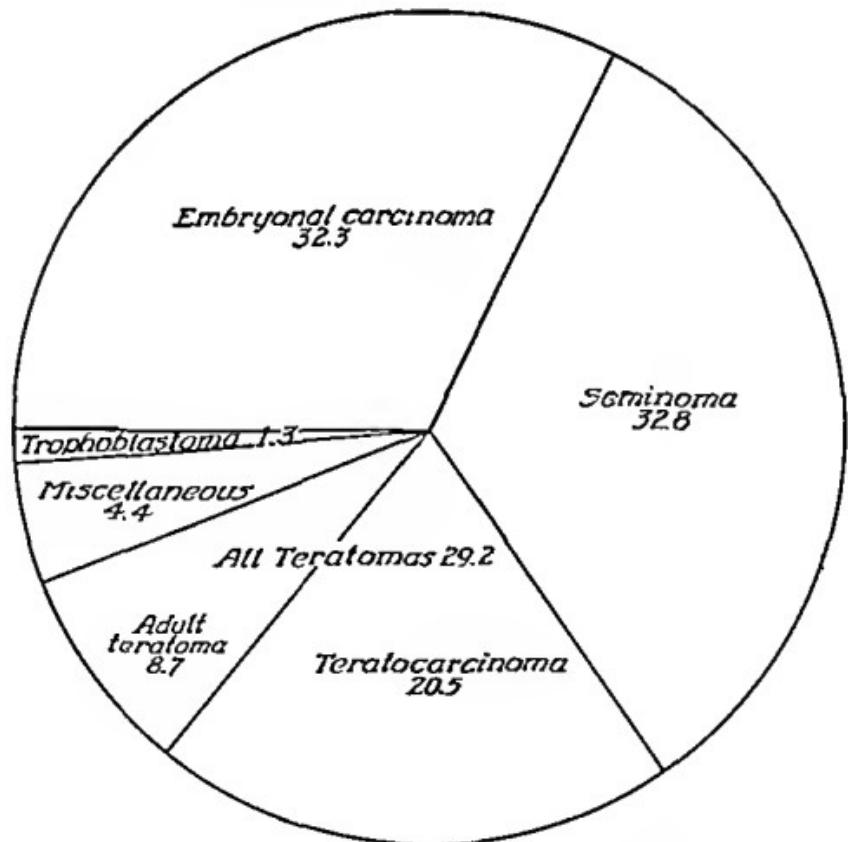


Figure 15.—Percentage distribution of testicular tumors.

TABLE 1.—Follow-up in 216 cases of tumor of testes

Total number of tumors	Time fol lowed in each case	Seminoma			Teratoma			Embryonal carcinoma				
		Number fol lowed	Total number dead	Mortal ity	Percent	Number fol lowed	Total number dead	Mortal ity	Percent	Number fol lowed	Total number dead	Mortal ity
216	6 months	15	6	40	40	67	4	5.9	5.9	11	23	31
211	1 year	71	11	14.9	67	14	26.9	36	49	73	36	49
213	2 years	71	19	26.8	67	29	41.9	73	51	60	51	60
210	3 years	69	21	30.4	63	31	49.2	41	55	55	55	55
142	4 years	61	21	34.4	55	31	56.8	61	56	56	56	56
167	5 years	52	21	40.4	45	31	74.4	65	56	56	56	56
119	6 years	46	22	47.8	42	35	83.3	61	56	56	56	56

The testicular tumors forming the basis of this study were classified histologically as follows:

#### Gonocytic series.

##### 1. Seminoma

- a. Typical.
- b. With lymphoid tissue

##### 2. Adult teratoma.

- a. Typical cystic
- b. With mesenchymal tissue predominating

##### 3. Teratocarcinoma.

- a. Teratoma with neuroblastic tissue predominating.
- b. Teratoma with embryonal carcinoma predominating.
- c. Teratoma with chorioepithelioma.

##### 4. Embryonal carcinoma

- a. Typical or pure type.
- b. Embryonal carcinoma with seminoma
- c. Embryonal carcinoma with chorionic tissue.

##### 5. Chorioepithelioma or trophoblastoma.

#### Nongonocytic series:

1. Androblastoma (derived from Sertoli cells)
2. Interstitial cell tumor.
3. Lymphangioma or adenomatoid tumor of epididymis.

#### AGE DISTRIBUTION

The origin of testicular tumors is related to the maturation of testicular function. Gonadal development is at its maximum from the onset of puberty at about 13 or 14 years of age to the end of adolescence at about 16 or 17 years of age. Sexual maturity appears between the ages of 18 and 25. The highest incidence of testicular tumors occurs after sexual maturity during early adulthood, ages 26 to 35, rather than during adolescence.

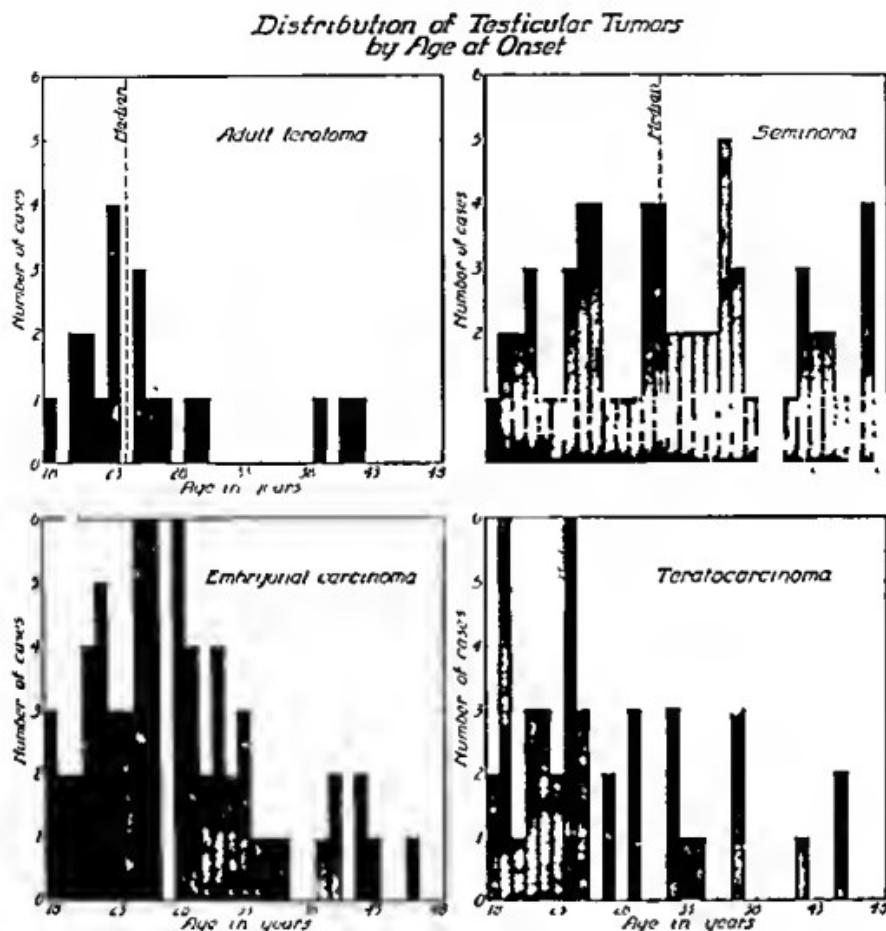


Figure 16.—Median age groups.

In our series a study of the age distribution for the four types (table 2) showed that seminoma occurred comparatively much later than the other three types (fig. 16).

The age distribution shows the median to occur as follows: (a) seminoma, 31 years; (b) teratoma and teratocarcinoma, 24 years each; and (c) embryonal carcinoma, 26 years.

There is a difference of 7 years between the median age of seminoma and of the teratomas. This closely approximates the findings of Friedman and Moore who found a 5-year difference between the mean age for seminoma and teratocarcinoma. Embryonal carcinoma occurred somewhat later—about 2 years—than the teratomas. In our series the incidences were not corrected for the population distributions of the various age groups. In addition to Navy personnel some of the

cases were Veterans' Administration patients and some were civilians and the total population represented by these cases is not known. The median rather than the arithmetic mean was used owing to a limited number of extreme values which would distort the true nature of the age distribution.

TABLE 2—Age distribution in 169 cases

Age	Seminoma	Adult teratoma	Teratocarcinoma	Embryonal carcinoma	Age	Seminoma	Adult teratoma	Teratocarcinoma	Embryonal carcinoma
18	1	1	2	3	25	2	0	0	1
19	2	0	5	2	30	5	0	0	1
20	2	1	2	2	37	5	0	3	6
21	2	2	3	4	35	1	0	0	6
22	1	1	3	3	39	0	1	0	1
23	1	4	2	3	44	0	0	0	2
24	3	0	6	2	41	1	1	0	0
25	4	3	3	6	42	3	1	1	2
26	1	1	0	6	43	2	0	0	0
27	1	0	0	6	44	1	0	2	0
28	1	1	3	4	45	0	0	6	1
29	4	1	0	2	46	4	0	0	0
30	4	0	0	4	47	0	0	0	0
31	2	0	3	2	48	1	0	0	0
32	2	0	1	1	Total	62	19	43	68
33	2	0	1	1					
34	2	0	1	1					

### CLINICAL FEATURES

The clinical symptoms of testicular tumors are indefinite. A painless swelling of the testicle which enlarges gradually over months or years is the rule. The tumor affects the body of the testicle rather than the epididymis. Pain is associated only with trauma or hemorrhage. Symptoms of longer duration occur in the more slowly growing tumors, such as the seminomas. In 169 cases of our series the duration of symptoms prior to operation was given. In cases of seminoma it was 14 months; in embryonal carcinoma it was 6.9 months; and in teratoma and teratocarcinoma, it was 4.8 and 4.6 months respectively.

Cryptorchism was not an important feature in our series. Patients with undescended testicle are not accepted for naval service. However, cryptorchism was present in three cases of seminoma; but these were cases in civilian persons included in our study.

Bio-assay for gonadotrophic hormones was helpful for diagnosis in only an occasional case, which was either a frank choriocarcinoma or where chorionic tissue was contained in tumors having the pathologic features of teratocarcinoma or embryonal carcinoma.

### TREATMENT

The treatment in these cases has been standardized in the past 20 years in naval hospitals, and consists of ligation of the cord at the

internal inguinal ring and excision of its distal portion along with the testicle. This is followed by external irradiation therapy through multiple ports by the divided dose technic, using 250 kv. A total of between 8 and 10 thousand roentgen units is given to the node-bearing areas—the right and left inguinal regions, and the hypogastric and preaortic group up to and including the region at the bifurcation of the aorta. The details of the operation were available in every case and in no case was radical orchiectomy performed (removal of the

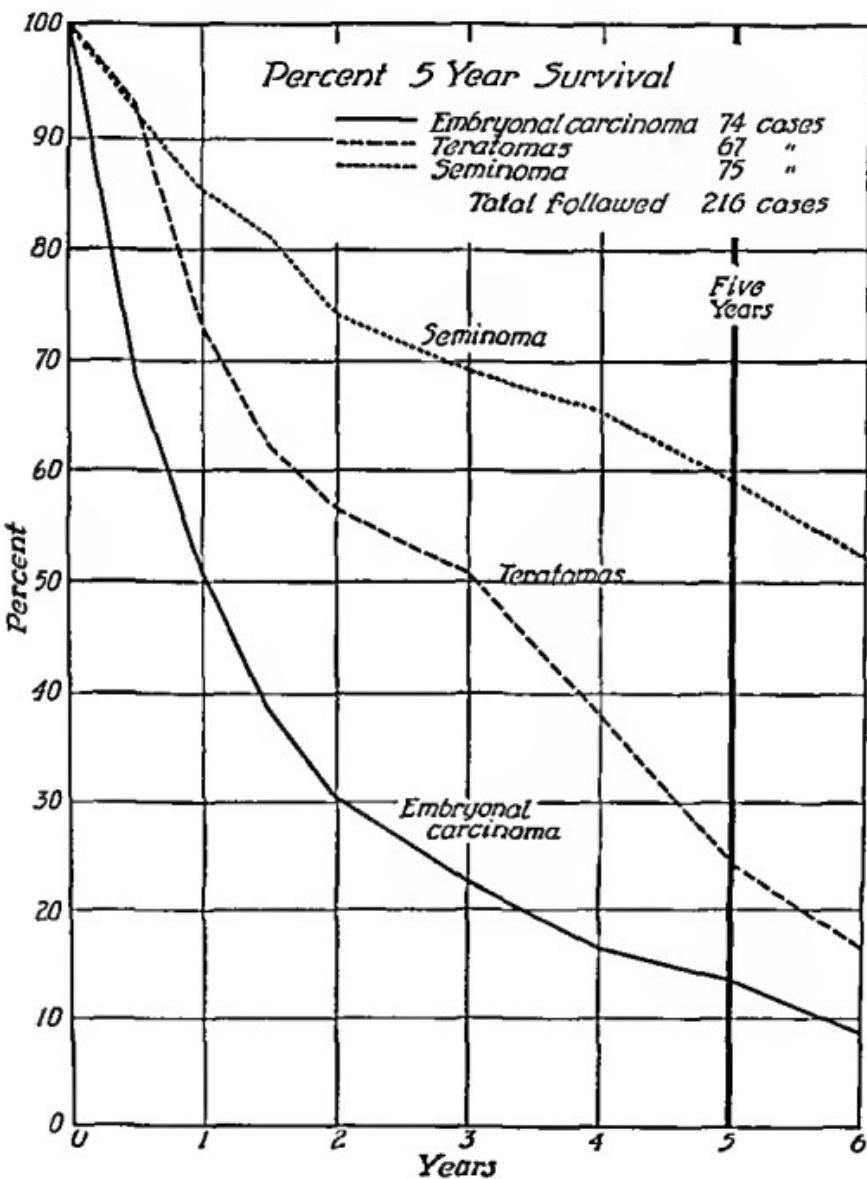


Figure 17.

testes, the entire spermatic cord, and the retroperitoneal lymph chain from the inguinal ring to the renal pedicle). However, in two cases bilateral orchectomies had been performed. Less adequate data were available on the technic of irradiation. However, in 80 percent of the records postoperative irradiation was in accordance with that previously noted.

#### END RESULTS

The 5-year survivals in seminoma are approximately 60 percent, in teratomas, 24 percent; and in embryonal carcinoma, only 14 percent. The over-all 5-year survival rate is 31.7 percent. The mortality rates are greatest in the first and second years after operation. Of the 216 cases, 148 have been followed a minimum of 6 years; they are presented graphically to show that the general mortality trend continues beyond the "five-year" survival period (fig. 17).

The number of cases of pure choriocarcinomas, 3, and nongonocytic tumors, 10, is too small for critical statistical analysis.

#### DISCUSSION

Prior to recent years it was the consensus that seminomas constituted about two-thirds of all testicular tumors and that about 45 to 50 percent of patients with this condition survived 5 years or longer. The teratomatous tumors were considered to make up one-third of the total of the testicular new growths, and had a 5-year survival rate of about one-half that of seminoma. The reason for this misinformation was the inclusion of the embryonal carcinomas in the seminoma group. This distinction is sometimes made with difficulty and is an important one from the standpoint of prognosis. Friedman and Moore emphasized the importance of distinguishing between these two types of testicular tumors and our survival rates re-emphasize this point. Seminoma has a 5-year survival rate of 60 percent which is more than four times the 14 percent for embryonal carcinoma. Not only do the patients survive 5 years or longer but "permanent" cures are by no means rare and we have patients who had seminoma surviving 11, 12, 15, 17, 18, 20, and 21 years. An interesting case report in this group is the following: In 1929, at the age of 21, the patient had a unilateral orchectomy for seminoma. In 1935 a seminoma appeared in the remaining testis for which a simple orchectomy was also performed. He is living and well 20 years following the first surgery. Some writers believe that in contrast to seminoma, cures among embryonal carcinoma are exceedingly rare unless radical surgery is performed. Our statistics do not bear this out. There are records of patients with embryonal carcinoma who survived 6, 7, 8, and 11 years and of 5 patients who survived over 5 years; in these the treatment consisted

of unilateral orchiectomy and postoperative roentgen irradiation with 250 kv. In cystic teratoma and teratocarcinoma the survival rates lie between those of seminoma and embryonal carcinoma. Cures were recorded for both types of teratoma, and two patients with teratocarcinoma surviving 12 and 26 years and several with cystic teratomas living 10 to 11 years. Patients with teratoblastoma or chorioepithelioma rarely survive 5 years. There is one exception—a patient 23 years of age at time of operation who is living and well 6 years after treatment.

#### SUMMARY

The significant pathological features of tumors of the testes are as follows: (a) Seminoma has a uniform type of cell without particular arrangement in lymphoid stroma. (b) Teratoma shows islands of cartilage, and epithelial proliferation of either benign or of malignant character and may also show cyst formation. When malignant neuroepithelium, chorionic tissue, or cells resembling embryonal carcinoma are present the tumor can be classified as teratocarcinoma. When cysts lined by mature epithelium are present it falls into the classification of adult or cystic teratoma. From a practical standpoint it is probably not necessary to differentiate between these two. Both types are malignant although cystic teratoma has a slightly better prognosis. However, in our experience, if multiple sections are taken, most cases of cystic or adult teratoma will be reclassified as teratocarcinoma. (c) Embryonal carcinoma can be classified on the basis of large neoplastic epithelial cells in crescent or pseudo-acinar arrangement.

A tabulated summary of the features of testicular tumors is presented in table 3.

TABLE 3

Pathologic type	Total number of cases	Percent of all types	Median age	Average duration of symptoms	5-year survival
	Years	Months	Percent		
Seminoma.....	72	32.6	31	4.6	59.6
Teratoma.....	57	29.2	21	4.7	21.4
Embryonal carcinoma.....	74	32.3	26	6.0	13.8

Seminoma, teratoma, and embryonal carcinoma occur with about equal frequency in any large series.

The prognosis in both adult and carcinomatous varieties of teratoma is about the same.

Rare types of testicular tumors compose slightly over 5 percent of the total.

The 5-year survival rate of seminoma is 59.6 percent, and is twice the survival rate of 24.4 percent for teratomas and approximately four times the survival rate of 13.8 percent for embryonal carcinoma.

The over-all 5-year survival rate in testicular tumors is 31.7 percent.

Comparison of the results in this series with those in the literature show that unilateral orchectomy followed by postoperative irradiation with 250 kv. is the treatment of choice; the survival rates are not enhanced by more radical surgery or more intensive irradiation.

There is a direct correlation between duration of symptoms and the degree of malignancy: especially in the case of the seminoma as compared with the other types.

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# Torsion of the Spermatic Cord

GLADEN R. HAMILTON, Lieutenant Colonel, MC, U. S. A.<sup>2</sup>

ALTON B. PEYTON, Major, MC, U. S. A.<sup>1</sup>

LOUIS K. MANTELL, Lieutenant Colonel, MC, U. S. A.<sup>2</sup>

TORSION of the spermatic cord, commonly but incorrectly considered as torsion of the testis, is not rare. The recent admission to this hospital of three undiagnosed, and consequently neglected, cases has emphasized the necessity of increased awareness of this condition by all medical officers. Early diagnosis is important. The dispensary surgeon must be especially cognizant of the condition since he is in a position to diagnose this abnormality which is easily corrected if treated early. A delay of only a few hours in proper treatment means the difference between a necrotic, atrophic testis and the retention of a viable, functioning organ. Two of these cases are presented as illustrations of erroneous diagnoses. The third, with the same pathologic findings, treated conservatively elsewhere for 5 weeks is not described in detail.

## CASE REPORTS

**Case 1.**—A 28-year-old man was admitted 20 days following an acute onset of pain in his left testis which occurred when he crossed his legs. He had received sulfadiazine and penicillin with slow regression in the extreme swelling of the left scrotal contents. On admission, the testis was about five times the normal size, was hard, and was suggestive of a tumor. Neglected torsion was



Figure 1.—Case 1. Torsion of left spermatic cord. A. Testis. B. Site of torsion. C. Tunica vaginalis and cord.

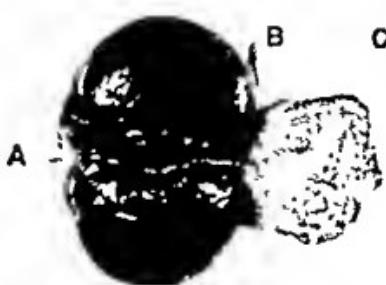


Figure 2.—Hemorrhagic infarction of testis. A. Testis. B. Site of torsion. C. Tunica vaginalis and cord.

<sup>1</sup> Brooke General Hospital, Fort Sam Houston, Tex.

considered because of a history of at least three similar episodes of acute testicular pain, each of which terminated spontaneously after a short time. Surgical exploration demonstrated a 180° clockwise twist in the spermatic cord with infarction of the testis which required orchectomy (figs 1 and 2). The underlying bell-clapperlike deformity on the opposite side was corrected.

**Case 2**—An 18-year-old man was admitted to this hospital 4 days after waking suddenly with a severe pain in his left testis. There was immediate swelling which subsided only slightly under treatment with bed rest, penicillin, and sulfonamides. Examination revealed an enlarged, firm testis and scrotal edema. Thickening of the spermatic cord immediately above the scrotum was minimal. Prostatile secretions showed 15 to 20 leukocytes per cubic millimeter. Surgical exploration demonstrated a torsion of the spermatic cord with infarction of the testis which required removal. The opposite testicle was treated as in the preceding case.

#### INCIDENCE

Undoubtedly the actual occurrence of this condition far exceeds the reported incidence. Ewert and Hoffman (1) collected 489 cases since the first formal report of this entity in 1840; they quote Wolf as having diagnosed the condition in a 68-year-old man. In the past 2 years the authors have observed three cases in infants ranging from 2 weeks to 16 months of age. Either side may be affected; in 24 of 330 cases collected by Ormond (2) torsion of the spermatic cord had occurred on both sides.

#### PATHOLOGY

Torsion of the spermatic cord never occurs in the normal testis, for in the normal scrotum it is impossible to rotate the testis to any great degree. In the usual type of torsion of the spermatic cord an abnormality, either developmental or acquired, exists. There are two

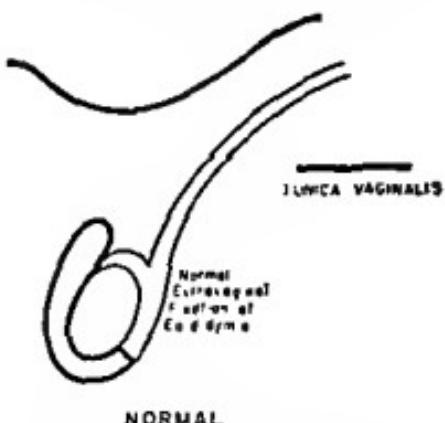
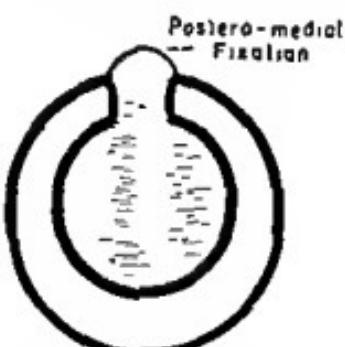
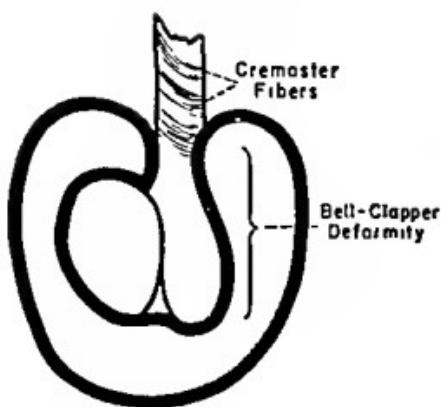


Figure 3.—Normal tunica vaginalis investment of the testis (after Muschel (3)). The tunica vaginalis covers the testicle and anterior part of the epididymis.



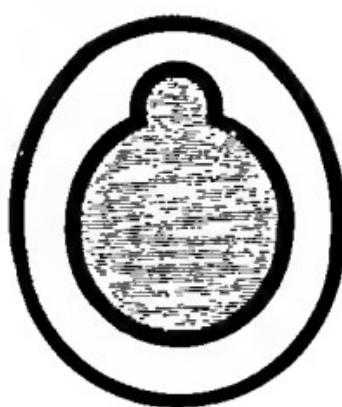
#### NORMAL CROSS SECTION

Figure 4.—Cross section of normal tunica vaginalis investment (after Muschel (3)). Note the extratunical epididymis.



### TORSION CASE

*Figure 5.—Abnormality of tunicary investment in torsion (after Muschat (3)). The low extension of the cremaster in high investment of the cord which results in torsion is illustrated.*



### TORSION CASE

*Figure 6—Cross section of abnormal tunicary investment in torsion (after Muschat (3)). The testis and epididymis are freely movable in the vaginal sac, making rotation possible.*

types: (a) extravaginal (rare) often associated with trauma, and usually associated with incarcerated hernia or as a result of direct trauma in cryptorchism; and (b) intravaginal (more common) amenable to surgical corrections when diagnosed early, and almost always associated with a serosal developmental anomaly. Figures 3 and 4 demonstrate the normal tunicary investments of the testis. The posteromedial aspect of the epididymis normally lies outside the tunica vaginalis. Figures 5 and 6 show the commonly encountered abnormality that results in a free-lying testis and epididymis within the parietal tunica vaginalis.

The names "dangling testis," "floating testis," "intratunieary pedicle," and "bell-clapper deformity" have been applied to this deformity. An additional feature demonstrated by Muschat (3) is high investment of the cord by the tunica vaginalis with downward extension of the cremaster muscle. Its contraction is the second etiologic factor in the production of torsion. Torsions of the left testis are predominately clockwise while those of the right are counter-clockwise. In some instances the epididymis and testis are joined by a mesentery sufficiently long to allow rotation and strangulation of its blood supply (4). Once torsion is established there are two possible terminations if prompt surgical treatment is not given: (a) spontaneous detorsion which occurs often enough to provide a suggestive point in diagnosis; and (b) hemorrhagic infarction resulting either in necrosis or fibrosis of the testis. Spontaneous detorsion is illustrated by the following case.

**Case 3.**—A 20-year-old man was admitted complaining of severe pain in the left testis and groin and nausea of about 1 hour's duration. There had been two similar transient episodes in the preceding 2 days. The testis was acutely tender and drawn up against the pubis. En route to the ward, the pain spontaneously subsided, and local findings the following morning were limited to moderate tenderness and increased tension of the affected testis. Both testes were unusually mobile. There was a history of at least one prior similar episode on the other side. A diagnosis of spontaneous detorsion of the left testis was made. On surgical exploration a typical bell-clapperlike deformity was demonstrated. Bilateral fixation was accomplished by excising the parietal tunica vaginalis and suturing the lower pole of the epididymis in its normal posteromedian position.

### SYMPTOMS

With the onset of torsion, the chief symptom is acute severe pain in the testis or groin. Typically, the onset is sudden, following strain or slight and inconsequential trauma. The onset of pain has occurred during sleep. The severity of the pain depends on the completeness of the twisting and it may disappear as a result of spontaneous detorsion. This occurs with such frequency that a history of preceding similar attacks terminating spontaneously may be considered suggestive of torsion of the spermatic cord. (See cases 1 and 3.) Nausea, vomiting, and sometimes shock may be present. Usually, there is no temperature elevation and an important point in differential diagnosis is the absence of leukocytosis early in the course. Normal urine, prostate, and seminal vesicles in the presence of the preceding symptoms is indicative of torsion, but there is nothing to prevent torsion from occurring in a man with an infected prostate (2).

### LOCAL FINDINGS

The affected testis is usually drawn up to the upper scrotum or inguinal region. There is extreme tenderness. This may be so acute that adequate examination is impossible. Unless the testis has rotated through 360°, the epididymis, normally in a posteromedian position, will be abnormally placed. Elevation of the testis causes an increase in pain, a characteristic and almost diagnostic sign (3). Edema occurs rapidly and there is nearly always an accumulation of fluid within the tunica vaginalis. In the early stages this is serous but later it becomes serosanguineous.

### DIFFERENTIAL DIAGNOSIS

The principal condition that may cause confusion in the diagnosis of torsion of the spermatic cord is acute epididymitis, in which the onset is more gradual, there is early leukocytosis, there is usually some elevation of the temperature, the enlarged epididymis is usually palpable in a normal position, and elevation tends to relieve the distress.

Similar findings are present in acute epididymo-orchitis, but the symptoms are more fulminating. In primary acute orchitis the cord structures are usually normal. Strangulated hernia may simulate the rare extravaginal torsion. Differential diagnosis is not, however, difficult except in the presence of cryptorchism. Vomiting is more frequent in cases of strangulated hernia.

#### TREATMENT

The treatment of this condition is always surgical. If detorsion is accomplished by manipulation, fixation of the involved testis and the opposite symptomless side is mandatory since the underlying congenital anomaly is usually bilateral. Adequate fixation is easily accomplished by excision of the parietal tunica vaginalis as performed in the usual hydrocelectomy. Spinal or local anesthesia is preferable.

When a reasonable doubt exists, scrotal exploration should be performed. The following case is illustrative.

**Case 1**—On 9 June 1947, an 18-year-old man was admitted 30 minutes after the onset of symptoms. He had recently been treated in this hospital for multiple urethral strictures, chronic urethritis, and cystitis. He had awakened with excruciating pain in the right testis, and had vomited once. He appeared acutely ill, and despite a normal temperature his leukocyte count was 14,000. His right scrotum was red and mildly edematous. His right testis was drawn upward to the external ring and because of severe pain, even after an injection of morphine, adequate local examination was impossible. Despite the known urinary tract infection, immediate exploration was performed under spinal anesthesia. On opening the tunica vaginalis, 4 cc of smoky amber fluid were removed. A blue, discolored testis and epididymis were lying free within the parietal tunica vaginalis, and extreme torsion of the spermatic cord was present. The torsion was corrected, and within 5 minutes the testis resumed its normal color. The parietal tunica vaginalis was excised, with fixation of the testis to the scrotal sac; a two-layer closure was performed without drainage, and coalescence was uneventful. Subsequently, the left scrotum was explored, revealing a free-lying testis and epididymis, with high investment of the cord, constituting the typical bell-clapperlike deformity. The patient was observed for several months and there was no atrophy of the right testis.

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# Primary Bronchogenic Carcinoma

JAMES H. FORSEE, Colonel MC U S A<sup>1</sup>

JOHN M. SALTER, Lieutenant Colonel MC, U S A<sup>1</sup>

ROBERT T. GANTZ, Colonel MC, U S A<sup>1</sup>

**P**RIMARY carcinoma of the lung is a curable disease if the diagnosis is made sufficiently early and if complete surgical removal is performed without undue delay. Since Evans Graham performed the first successful pneumonectomy for carcinoma of the lung in 1931 the safe surgical technique for pneumonectomy has far surpassed the clinical advances in the early diagnosis of this lesion (1). Since 1933 several hundred successful pneumonectomies have been performed for cancer of the lung in this country. Thanks to the rapid improvement in endotracheal anesthesia, to whole blood transfusions, antibiotics, and the appreciation of the pulmonary physiology concerned in the pre- and post-operative care of these patients, pneumonectomy has become rather commonplace. We hope for further advances in this field of surgery, but are primarily concerned with the early diagnosis of this dreaded disease. Cancer of the lung comprises from 8 to 15 percent of all cancers in man. It therefore behoves all members of our profession to keep the possibility of this disease constantly in mind, and to exhaust all diagnostic aids to account for unexplained abnormal roentgenographic findings in the thorax associated or unassociated with symptoms.

This article analyzes the recent experience in the diagnosis and treatment of bronchogenic carcinoma at this hospital. In the military service we probably see a larger percent of young men with malignant disease than is ordinarily seen in civilian practice. In the past 5 years we have not encountered cancer of the lung in a female patient. Ninety percent of our admissions have been men. Between 1 January 1944 and 31 December 1948, 9125 patients were admitted to this hospital. Ninety-one had carcinoma of the lung, proved by histologic examination. The apparent or actual increase in the incidence of this disease is revealed by the fact that of the deaths in this hospital from 1921 to 1940 cancer of the lung was found at autopsy in 27 as compared

<sup>1</sup> Fitzsimons General Hospital, Denver, Colo.

to 55 in the period from 1 January 1944 to 31 December 1948. The ages in this series varied from 22 to 76 years. Sixty-two percent were under 50 years of age and 8 percent were between the ages of 22 and 30 years. Eighty-five were white, five were Negroes, and one was Japanese.

Although the symptoms of primary carcinoma of the lung may be quite variable, most patients present a characteristic history. Initially, the symptoms resemble those of inflammation and depend on the size and location of the tumor as well as the degree of ulceration and obstruction of the bronchus. Seventy percent complained of cough, 53 percent had pain in the chest and weight loss at the time of admission, and 25 percent had hemoptysis. Of these 4 most prevalent symptoms of the disease, cough was the most common initial symptom. In nine patients the duration was less than 30 days and in 26 percent the presenting symptoms were of not over 90-day duration. In 14 patients the lesion was discovered by means of a routine roentgenogram of the chest. Seven of these patients were asymptomatic and five had already reached the inoperable stage. These data emphasize the necessity for immediate and thorough clinical study of patients with suggestive symptoms or findings and the desirability of routine roentgenograms of the chest.

Positive physical findings were more variable than the symptoms. Physical examinations of the chest were negative in 29 patients. Positive findings included various combinations of inspiratory and expiratory sibilant rales, fine to coarse rales, decreased expansion of the involved hemithorax and dullness over the suspected area. It was frequently noted that a relatively small tumor that occluded a main bronchus would give physical findings suggestive of atelectasis or pneumonia, while a peripherally located lesion of greater size that did not obstruct a main bronchus or invade the pleura would produce relatively few physical signs. The less frequent signs of cavitary disease were suggestive of abscess formation complicating the obstructing lesion. It is important to palpate for metastatic peripheral lymph nodes that may occasionally be found in the axillary, supraclavicular, and cervical regions. The involvement of such nodes indicates inoperability. The extent of the atelectasis or pneumonia is no criterion of the size of the tumor: it generally exceeded the size of the neoplasm.

The late diagnosis of this disease can often be attributed to the insidious development and absence of symptoms in a small bronchial or peripheral pulmonary neoplasm. The patient or the physician often mistakes the carcinoma for pulmonary tuberculosis, virus pneu-

monia, bronchitis, asthma, bronchiectasis, or a chest cold, causing unnecessary delay in establishing the true diagnosis. Often temporary improvement is seen when the bronchial obstruction is intermittent or when antibiotics are employed with temporary abatement of complicating symptoms. These factors often add to the delay in arriving at the correct diagnosis. Jones (2) states that "clinical improvement following antibiotic or chemotherapy without complete roentgenographic clearing of a bronchopulmonary lesion in an adult is indicative of at least a tentative diagnosis of primary bronchiogenic new growth until proved otherwise." We strongly concur in this statement. The most important factor in the early diagnosis of this disease is for the physician to require roentgenographic study of the chest in patients with chest symptoms and to demand surgical exploration for unexplained abnormal roentgenographic findings. A history of previous pulmonary disease is of interest but of no particular diagnostic significance. Studies relative to smoking among patients indicate it to be a factor in this disease. The diagnostic aids employed in this study included (a) roentgenography (routine and special projection roentgenograms of the chest, fluoroscopy, tomograms, bronchograms, and studies for bone metastasis); (b) physical examination; (c) bronchoscopy;<sup>2</sup> (d) sputum and bronchial secretion studies for tumor cells; (e) biopsy of a specimen from the peripheral lymph nodes; (f) study of pleural fluid for tumor cells; and (g) exploratory thoracotomy. Table 1 indicates the initial or early clinical diagnoses made in our series and table 2 indicates the particular method by which the true diagnosis was accomplished. The roentgenographic appearance of bronchiogenic carcinoma has no distinctive characteristics. The finding of abnormalities is, therefore, an indication that complete clinical investigation is urgently required. In some cases this may include exploratory thoracotomy (figs. 1, 2, 3, and 4).

TABLE 1.—Initial clinical diagnoses in 91 patients with carcinoma of the lung

<i>Initial clinical diagnosis</i>	<i>Number of patients</i>	<i>Initial clinical diagnosis</i>	<i>Number of patients</i>
Carcinoma of the lung	23	Atelectasis	—
Undiagnosed pulmonary disease	22	Pleural effusion	—
Tuberculosis	11	Neurofibroma	—
Carcinoma, primary, site unknown	9	Lobar pneumonia	—
Bronchiectasis	6	Pulmonary cyst	—
Atypical pneumonia	3	Mediastinal tumor	—
Lung abscess	3	Total	91
Asthma	4		

This procedure may yield important information although the actual tumor may not be visualized. Narrowing, distortion, and fixation of bronchi offer aid in determining the nature of the pulmonary process and may assist in the evaluation of operability.

TABLE 2.—*Means by which true diagnosis was arrived at in 62 of 91 patients with carcinoma of the lung<sup>1</sup>*

	Number of patients
Biopsy of specimen removed bronchoscopically	38
Biopsy of specimen of peripheral lymph nodes, mediastinal lymph node, or chest wall	11
Biopsy of specimen of lung at thoracotomy or lobectomy	8
Malignant cells demonstrated in pleural effusion	1
Malignant cells demonstrated in sputum and bronchial secretion	4
Total	62

<sup>1</sup>The remainder were diagnosed at autopsy.

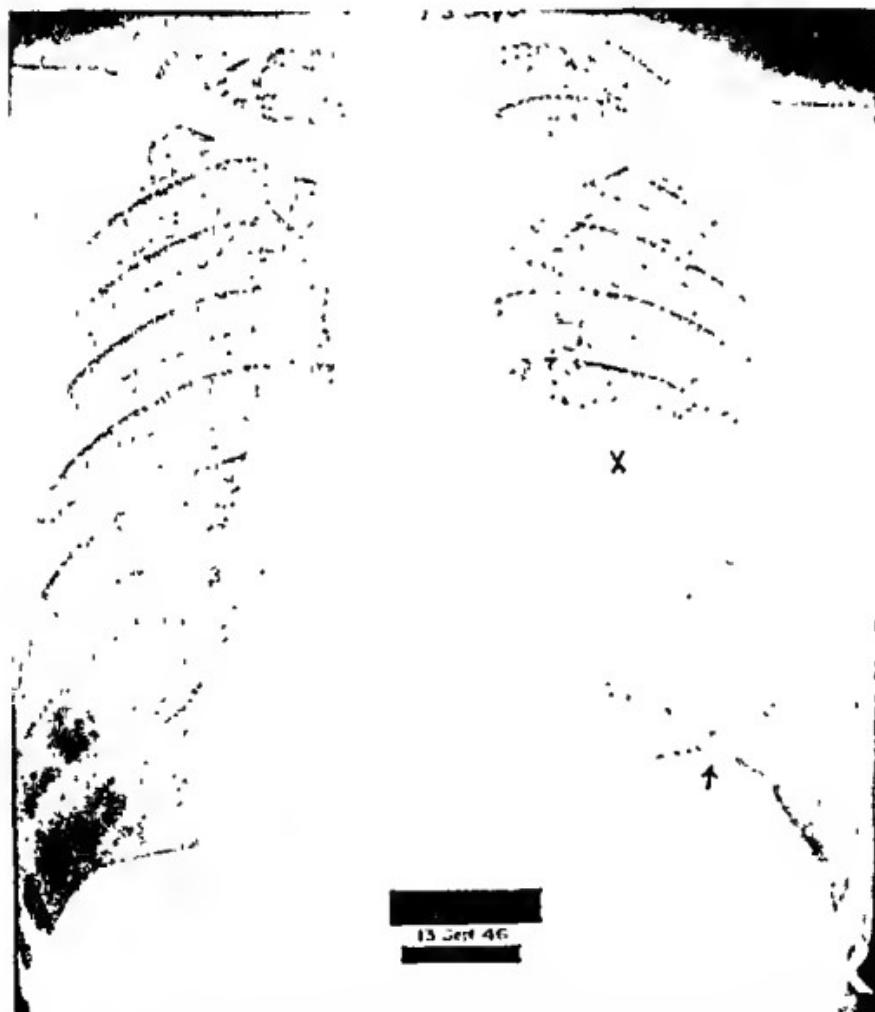


Figure 1.—Roentgenogram of chest of 47-year-old man with symptoms of 4 months' duration. The X marks a bronchogenic carcinoma. The arrow indicates what is probably an elevation of the diaphragm. The right lower lobe of the lung is somewhat enlarged and the trachea is slightly deviated.

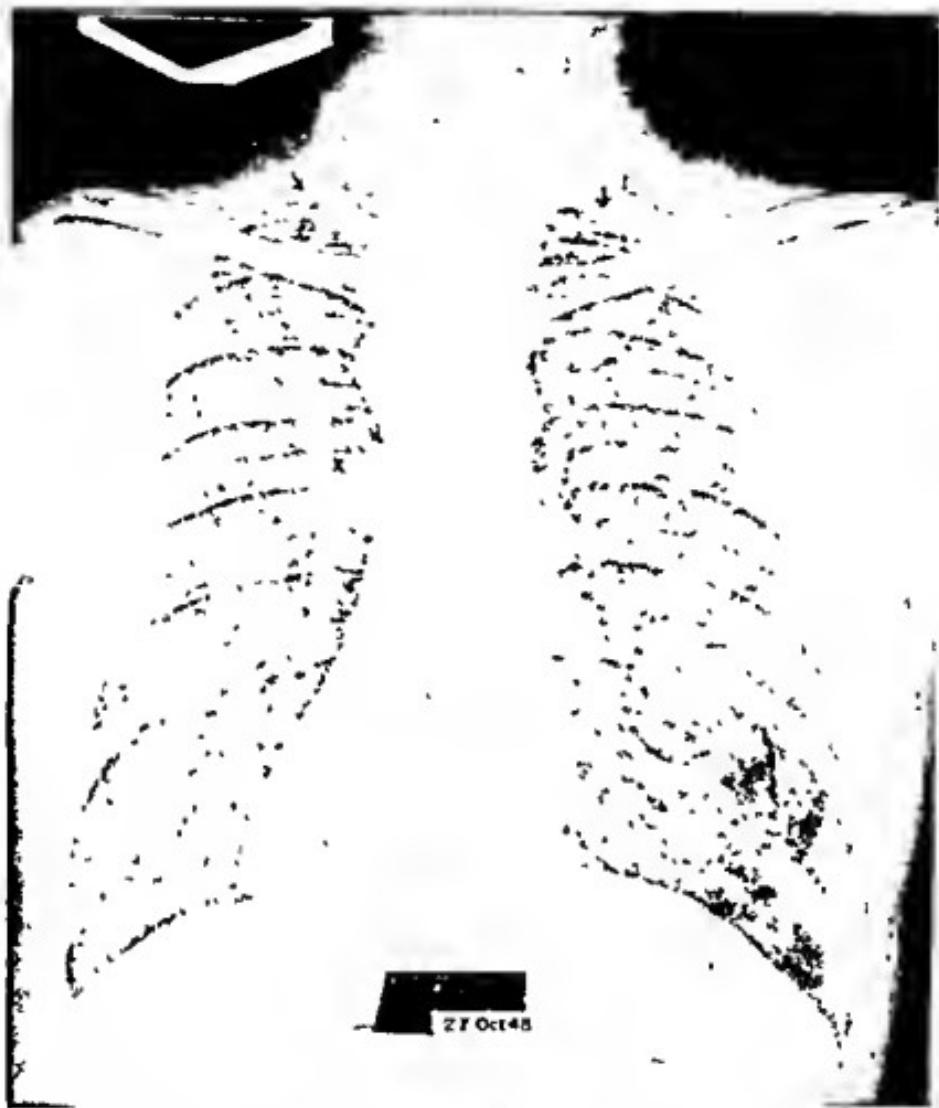


Figure 2.—Roentgenogram of chest of 53-year-old man with symptoms of 2 years' duration. The X marks a bronchogenic carcinoma. The arrows indicate probable pleural thickening. Biopsy showed evidence of carcinoma of the lung. A palliative pneumonectomy of the left lung was performed.

In attempting to arrive at a feasible method of management of carcinoma of the lung we have adopted these criteria. First, surgical excision offers the only hope of permanent cure. Second, surgical excision offers the best means of affording palliation in patients in whom complete removal of the tumor cannot be accomplished, if there is no evidence of metastases to distant organs. Ochsner (3) and his associates have stated that "70 percent of the resections were considered palliative rather than curative since the lesions had extended beyond the confines of the lung. Palliative resections are considered justifiable because the risk is not excessive, the patient's remaining

span of life is more comfortable, and the average survival period is increased." Our experience has been similar and we explore all patients in whom the diagnosis of cancer of the lung has been established who do not have (*a*) involvement of the tracheal wall, (*b*) metastatic lesions to distant nodes and organs, (*c*) malignant cells in the pleural fluid, and (*d*) conditions that preclude operative intervention such as severe cardiac or renal disease.

Radiation therapy has been used in those patients who were inoperable; it has been of doubtful value. In 22 of our patients the tumor

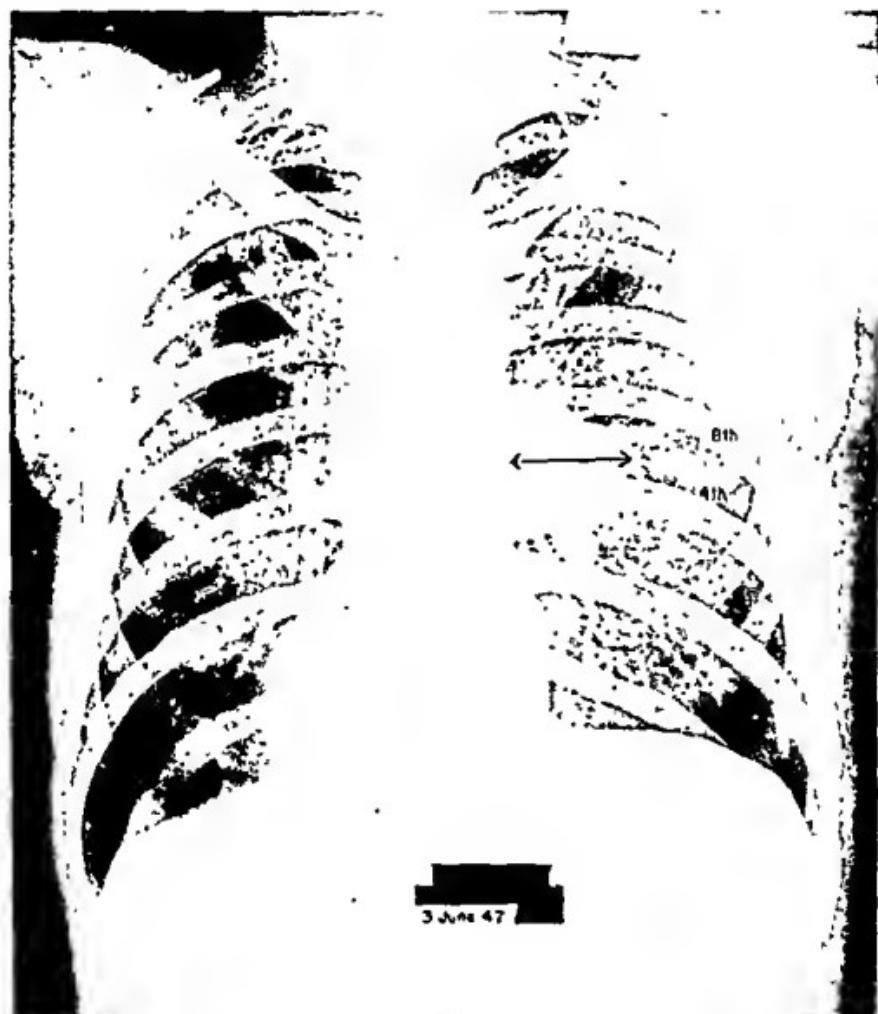


Figure 3.—Roentgenogram of chest of 57-year-old man with no symptoms. The carcinoma in his right lung was discovered by routine roentgenogram. The arrows indicate the site of the lesion. He was alive and working 2 years and 9 months after pneumonectomy of the right lung. The numbers identify ribs.



Figure 4.—Roentgenogram of chest of 53-year-old man with symptoms of 9 months' duration. A large cavity is seen in the right upper lobe of the lung. The arrows indicate the site of the lesion. An exploratory thoracotomy was performed but the tumor could not be removed.

was removed by pneumonectomy, in 6 by lobectomy, and in 1 by partial lobectomy. In about 50 percent the resections were considered palliative. There were 3 operative deaths. Four of the patients in this series were alive 2½ years or more following operation. Ochsner has shown that 25.9 percent of the patients survive 2 years after resection and that such patients have an excellent chance of 5-year survival.

#### CASE REPORTS

**Case 1**—A 41 year-old officer was admitted to this hospital on 9 October 1941 with a diagnosis of pleuritis chronic right, serofibrinous, tuberculous. He had been in good health until March at which time he developed a slight nonproductive

tive cough, chills, and night sweats. A roentgenogram of the chest revealed fluid in the right pleural space. He was treated with antibiotics and improved. He was returned to duty at his own request in April and was told that the fluid in his chest would absorb (figs. 5 and 6). He was asymptomatic for about 2 months when chills, fever, and night sweats recurred and he had a productive cough. He was admitted to another hospital where 50 cc. of bloody purulent fluid were obtained from the right pleural space by thoracentesis. The sputum was negative for tubercle bacilli and a roentgenogram of the chest revealed the pleural effusion to be increasing. The treatment consisted of bed rest. The patient grew rapidly worse. The clinical impression was pulmonary tuberculosis, moderately advanced, bilateral, with effusion in the right pleural space. Soon after admission he had symptoms of an obstructive jaundice. He was transferred to this hospital on 9 October. On 31 October bronchoscopy revealed a mass in

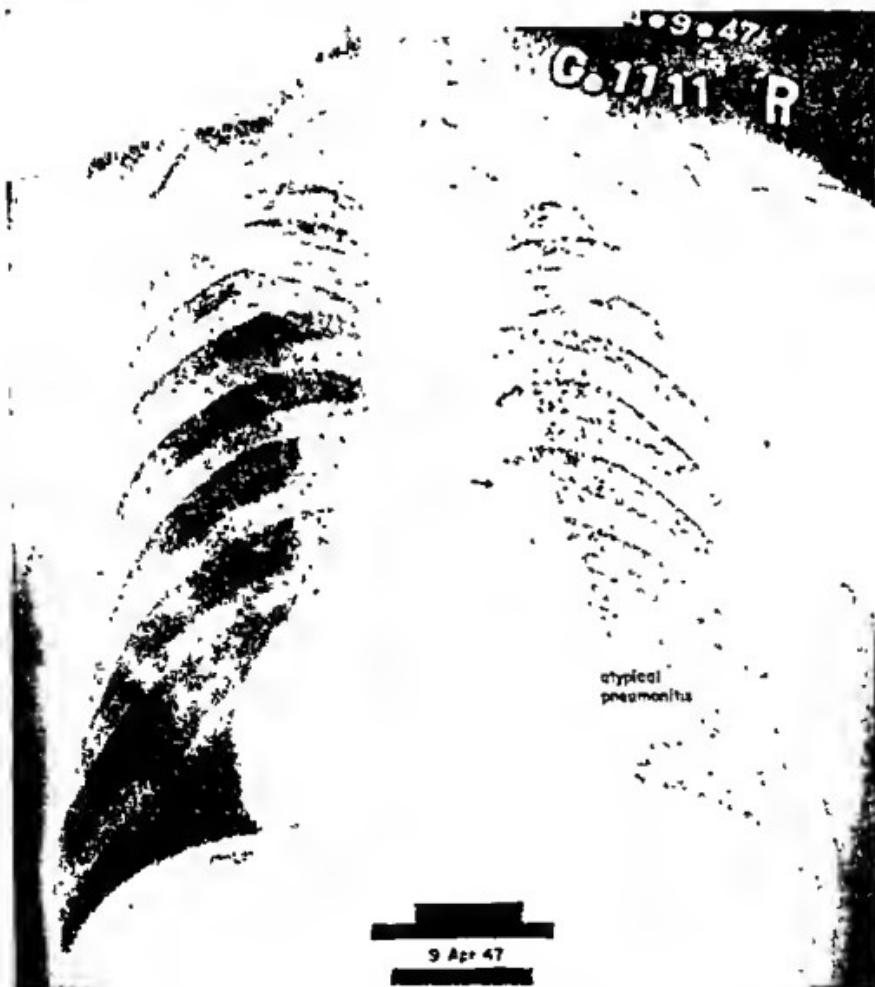


Figure 5—Case 1. Roentgenogram of chest. The arrow indicates the site of the bronchogenic carcinoma. The lesion marked "atypical pneumonitis" warranted complete investigation. The patient died 8 months later of carcinoma of the right lung.



Figure 6.—Case 1. This roentgenogram shows the importance of a lateral projection as an aid in diagnosis. The atelectasis warranted complete investigation. The arrows indicate the site of the lesion.

the right main bronchus. Biopsy of a specimen taken from this mass revealed a carcinoma and a specimen of a subcutaneous metastatic lesion of the right chest wall revealed a similar type of carcinoma. The patient died on 1 December. The post-mortem diagnosis was carcinoma bronchogenic, undifferentiated, right, with metastasis to hilar and paratracheal nodes, adrenals, right kidney, pancreas and brain. A proper investigation 6 months earlier might have permitted removal of the lesion and cure.

Case 2.—A 47-year-old veteran had been well until 1943 when he had a severe chest cold from which he never completely recovered. After a 2 month hospitalization he was discharged from the Army because of bronchitis. There were three subsequent admissions to hospitals for bronchitis. In December 1945 he was admitted to this hospital with pneumonia which, except for a small area

in the right lung, responded to penicillin therapy. He was discharged within 2 weeks and continued to work but was bothered by malaise, weakness, and cough productive of foul sputum. A roentgenogram of the chest was made at the request of the out-patient department in January 1946 (fig. 7). In September 1947 he had hemoptysis and was readmitted to this hospital. A roentgenogram of the chest revealed a demarcated, lobulated density in the midportion of the right lung (fig. 8). Bronchoscopy showed an obstructive lesion of the right lower lobe bronchus. Microscopic examination of a specimen of the mass disclosed bronchogenic carcinoma. A right pneumonectomy was performed on 23 September. He died on 7 December 1947. A more complete study in January 1946 might have revealed the true nature of this lesion.

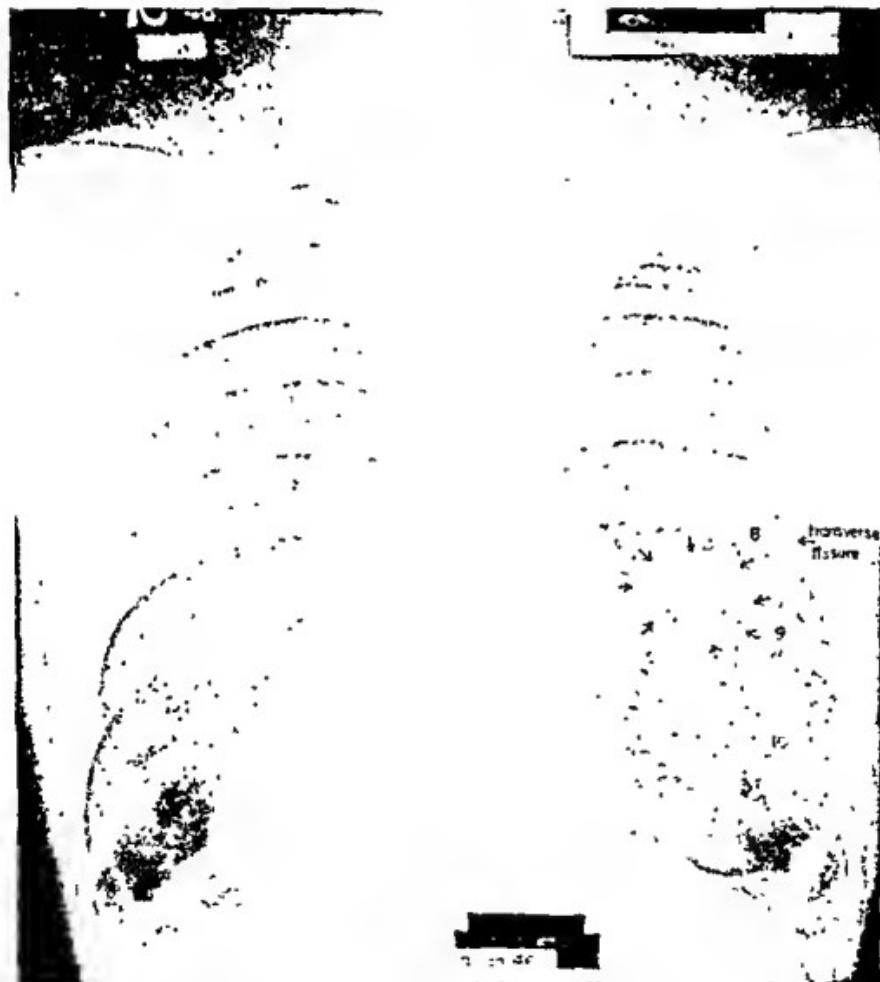


Figure 7.—Case 2. Roentgenogram of chest. The lesion in the right lung indicated by arrows warranted complete investigation. Numbers identify ribs. The patient died 23 months later of carcinoma of the right lung.

TABLE 3.—*Histopathologic classification of 91 cases of carcinoma of the lung*

<i>Classification</i>	<i>Number of cases</i>
Squamous cell-----	45
Adenocarcinoma-----	19
Undifferentiated-----	19
Miscellaneous	
Gelatinous adenocarcinoma-----	1
Adeno-epithelial-----	3
Mixed adenocarcinoma and squamous-----	1
Mixed undifferentiated and squamous-----	1
Mixed anaplastic and squamous-----	1
Type undetermined-----	1
Total-----	91



Figure 8—Case 2. Later view of same lung taken 2½ months before death.  
Numbers identify ribs.

All bronchogenic carcinomas are highly malignant. The histopathologic classification in this series is shown in table 3. At no time did microscopic study of the tissue and the histopathologic classification influence the operative treatment if a patient was judged operable from a clinical standpoint.

#### SUMMARY

Pulmonary cancer is now as common as any tumor involving the internal organs in male patients. The disease is believed to be increasing in frequency. The most common symptoms are cough, chest pain, weight loss, and hemoptysis, and patients often present a history pattern suggestive of this disease. Early diagnosis and surgical exploration may save or prolong life. Four patients in the series of 91 patients here reported have survived longer than 2½ years after complete or partial surgical removal of the tumor. Palliative resection of the lesion is recommended.

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# The Ante-Mortem Diagnosis of Secondary Tumors of the Heart

## Report of Four Cases

ROBERT M. DUMMETTE, Lieutenant, junior grade (MC) U. S. N.

SECONDARY tumors of the heart or metastasis to the heart have been considered rare, and various writers have reported the incidence as varying from 0.28 (1) (2) to 10.9 percent (3). Brick and Greenfield (4) in reporting rhabdomyosarcoma with cardiac metastasis, made an extensive review of the literature through 1946. From various surveys of autopsies from leading medical centers, they concluded that the frequency of cardiac involvement varies from 0.03 to 1.4 percent of the total number of autopsies and from 1.0 to 10.9 percent of the total number of cancers. They further noted that up to the time of writing their article, a total of 22 cases of tumor of the heart had been diagnosed ante mortem, of these tumors, 4 were primary (4) (5) (6). Since that report, Blumenthal and Peterson (7) reported the ante-mortem diagnosis of metastatic carcinoma of the heart secondary to a carcinoma of the cecum. A case of constriction of the pericardial sac by a neoplasm secondary to bronchogenic carcinoma was reported by Fischer (8). Ritz (9) reported a case of metastatic tumor of the heart from malignant melanoma, in which ante-mortem diagnosis was made by cell block of pericardial fluid.

In a review of 1,815 autopsies at the U. S. Naval Hospital, Philadelphia, Pa., from 1943 to 1949, 455 cases of malignant tumors were found. Of these, 38 or 8.35 percent were found to have secondary involvement of the heart. In 4 or 10.5 percent an ante-mortem diagnosis was made histologically or else tentatively diagnosed as the cause of cardiac signs and symptoms before death and confirmed by autopsy.

### CASE REPORTS

*Case 1*—G. A. L., a 62-year-old white man, was admitted to the hospital on 21 April 1947 complaining of a mass in the right axilla which had been found 10 days prior to admission.

*Past history.*—He had had occasional episodes of anorexia and dull aching pain in the right upper quadrant of the abdomen and black stools and constipation over a period of 9 years. Four years prior to admission a mole on his back had been cauterized without recurrence. Past history was negative for cardiac disease or symptoms. His best weight was 180 pounds, in 1931.

*Physical examination.*—The patient weighed 134 pounds, his blood pressure was 160/80 and the pulse rate 60 per minute. A firm, nontender, lobulated mass about 6 cm. in diameter was present in the right axillary space, seemingly attached to the pectoralis muscles. The heart examination revealed bigeminal rhythm. A systolic murmur was heard best at the apex, fading toward the base. The rest of the examination was essentially normal.

*Laboratory data.*—Urinalysis and red and white blood cell counts were normal; hemoglobin, 11 gm.

*Roentgenographic examination.*—Roentgenograms showed a duodenal ulcer with some contraction deformity. Barium enema was negative. A chest roentgenogram showed increased bronchovesicular markings.

*Electrocardiographic and microscopic examinations.*—On 22 April 1947 an electrocardiogram revealed a rate of 60 per min with sinus arrhythmia and sinus arrest. PR interval was 0.17 sec.; QRS was 0.08; the Q-waves, 1 mm. deep in leads 2 and 3. S-T segment was normal.

An electrocardiogram on 8 May 1947 showed complete heart block with the PR interval varying from 0.16 to 0.23 second. Every third P-wave, QRS complex, and T-wave were dropped. The S-T segment became isoelectric in leads 1, 2, and 3.

On 15 May 1947, under local anesthesia, a biopsy specimen was removed from the right axillary mass. The microscopic appearance was that of undifferentiated sarcoma compatible with malignant melanoma.

An electrocardiogram on 18 May 1947 showed a continued block and no change from the record of 8 May 1947.

*Tentative diagnosis.*—Secondary neoplasm of myocardium.

On 10 June 1947, the right axillary nodes were resected and the microscopic examination showed an undifferentiated sarcoma compatible with malignant melanoma.

*Out-patient course and return to hospital.*—The patient left the hospital on 18 June 1947 only to be readmitted 12 September 1947 with widespread pulmonary metastasis. He then had bilateral pleural effusion, progressive chest pain on slight exertion, dyspnea, orthopnea, and ankle edema. Cardiac examination revealed bigeminal rhythm and a murmur similar to that noted on previous admission. Blood pressure was 185/90.

A low fluid intake, salt-free diet, and digitalis were prescribed. His course was downhill and he died 28 September 1947.



Figure 1.—Case 1. Low-power magnification showing the neoplasm invading the myocardium in the region of the atrioventricular node.

**Autopsy**—The autopsy showed malignant melanoma of the right axillary region with metastases to the lungs, liver, pancreas, and thyroid. A chronic duodenal ulcer was present. The heart weighed 340 gm and was normal in contour. The major vessels and coronary arteries were patent. On sectioning, two metastatic tumor nodules were observed, both approximately 1 to 2 cm in diameter and located at the atrioventricular junction on the right side. The right ventricular wall measured 4 mm, the left 14 mm in thickness. The valve leaflets were slightly thickened, the chordae tendinae and papillary muscles were not unusual.

Tumor nodules were found in the atrioventricular node area. Upon microscopic examination these were typical of malignant melanoma, showing evidence of infiltration into the surrounding myocardium.

**Case 2**—H. H. C., a 52-year-old white man, was first admitted to the hospital in November 1944, complaining of sharp, steady, and nonradiating pain in the left thorax and arm which began in 1942. His family and past histories were noncontributory.

**Physical examination**—Examination revealed coarse rhonchi, inspiratory and expiratory rales over both lung fields. On percussion, the mediastinum was found to be widened and the heart to be enlarged. Frequent extrasystoles were audible. Blood pressure right, 130/90, left, 120/60.

**Radiographic examination**—A chest roentgenogram revealed a very large, somewhat lobulated area of increased density protruding from the left elbow to the outer fourth of the left lung field. The heart and mediastinum were displaced to the right and the trachea and esophagus were displaced posteriorly.

**Laboratory data**—Red and white blood cell counts were normal, hemoglobin, 12.5 gm. The blood Kahn test was negative. Urinalysis was negative.

**Electrocardiographic examinations**—An electrocardiogram revealed a rate of 108 per min and extrasystoles. P-R interval was 0.18 sec, QRS complex, 0.06 sec. ST-T segment was isoelectric. The T-waves were normal.

**Hospital course**—In March 1946, a thoracotomy was performed and what was thought to be an inoperable tumor extending into the pericardial cavity was found. The patient was discharged after convalescence and readmitted in October 1946. At this time, dyspnea and chest pain were more severe. A roentgenogram of the chest revealed little change in tumor density. In November 1946 via an anterior thoracotomy partial resection of the mass was performed. Following this surgery the patient died.



Figure 2—Case 2. A high-power magnification showing the brouchial adenoma in the myocardium with infiltrative fingers of neoplastic tissue surrounding cardiac muscle.

**Autopsy**—Post mortem examination revealed a solid tumor filling a major portion of the mediastinum and a major portion of the left lung. The resected specimen was filled with multiple lobulations of white soft tumor. A resultant pyelonephritis with nephrotic changes was present.

The heart weighed 405 gm. The pericardium was rough, dull, and showed involvement by direct extension.

of the mediastinal tumor mass. The ventricles were slightly hypertrophied and there was slight thickening of the mitral leaflets but otherwise the heart was grossly normal.

Microscopic examinations proved the tumor to be a bronchial adenoma. A focal site of neoplastic tissue identical with the lung sections was observed in the left ventricle. Infiltration was noted about the ill-defined margins of the neoplastic tissue.

**Case 3.**—W. G. G., a 57-year-old white man, was admitted on 6 May 1946 complaining of weakness, dyspnea after walking the distance of one-half block, weight loss of 13 pounds, and abdominal pain of 2-month duration. His general health had been good prior to his present illness.

**Physical examination.**—On admission, his pulse rate was 108 and blood pressure, 100/100. The heart showed regular rhythm and no murmurs or enlargement. The neck veins were noticeably distended. The liver was palpable at the right costal margin. No peripheral edema was present.

**Laboratory, roentgenographic, and microscopic data.**—Red blood cells, 3,100,000; white blood cells, 15,100. Hemoglobin was 85 gm. Sedimentation rate was 35 mm./60 min. Roentgenograms were not significant. A biopsy of a specimen from a mass in the left lower lobe bronchus revealed squamous cell carcinoma.

**Electrocardiographic examination.**—An electrocardiogram taken 10 May 1946 revealed a rate of 92 per min. with normal rhythm. P-R interval, 0.14 sec. The QRS, 0.08 sec. duration with low voltage and slurring in the limb leads. The S-T segment was isoelectric. The T-waves were flattened in lead 2 and inverted in lead 4.

**Cause and diagnosis.**—His course was downhill with evidence of cardiac decompensation. His temperature varied from 99° to 102° F. In light of these findings, a tentative diagnosis of secondary carcinoma of the heart was made. He died on 2 June 1946.

**Autopsy.**—The post-mortem examination revealed a primary squamous cell carcinoma of the lower lobe of the left lung with superimposed bronchopneumonia and multiple small lung abscesses. Secondary carcinoma of the squamous cell type was found in the liver and kidneys. A small amount of the abdominal aorta and a moderate degree of atherosclerosis of the aorta were found.

The heart weighed 430 gm. The major vessels were patent. The epicardium of the anterior surfaces of the right and left ventricles was covered with a sludgy, granular, yellowish brown fibrinous exudate. The valves and endocardium were grossly normal. The left ventricular wall measured 20 mm. in thickness. The interventricular septum revealed small, white, firm, solid flecks scattered diffusely throughout the myocardium. Microscopically, the interventricular septum was found to be infiltrated with secondary squamous cell carcinoma, scattered round-cell infiltration was present about the margins of the tumor.



Figure 3.—Case 3. Low-power magnification showing the squamous cell carcinoma invading the surrounding myocardium and extending along the fibrous septi.

**Case 4**—B. J. P., a 22-year-old white man, was admitted to the U. S. Naval Hospital Philadelphia, Pa., on 7 July 1948. In April 1947 he had been hospitalized at Walter Reed Hospital where biopsy of a specimen of a mediastinal tumor was reported as being a cavernous hemangioma. However, on review of the slides it was subsequently thought to be malignant teratoma.

At the time of entry into this hospital, he complained of severe substernal pain of 5-week duration with extreme dyspnea of 2-week duration. He was unable to lie flat in bed and had insomnia for this reason. He complained of coughing and nausea and had lost 12 pounds in the month prior to admission.

**Physical examination**—His pulse rate was 96 per minute; respiratory rate, 18 per minute. Temperature and blood pressure were normal. The chest showed dullness on the right side from 3 centimeters above the tip of the scapula downward and there was impairment of breath sounds. The neck veins were greatly distended. A soft mass was felt in the left supraventricular region. The liver was enlarged, soft, and tender.

**Roentgenographic examination**—A chest roentgenogram showed pleural effusion on the right side and an operative defect of the left sixth rib posteriorly. Obliteration of the left costophrenic angle was also seen.

**Hospital course**—He became increasingly dyspneic. Thoracentesis gave partial relief and examination of the fluid showed no tumor cells.

After 16 July 1948, his temperature remained about 101° F orally, daily. Despite repeated thoracentesis his dyspnea and right side heart failure con-



Figure 4—Case 4. High-power magnification of clumps of neoplastic cells found in the effusion fluid.



Figure 5—Case 4. A low-power magnification showing the masses of neoplastic cells isolating bundles of cardiac muscle. Note the pseudo-acinar formations in the neoplastic tissue.

tinued. The fluid obtained at thoracentesis on 20 August 1948 was found to contain neoplastic cells (fig. 4).

Because the pleural effusion was due to a neoplastic lesion, the pericardial effusion was logically attributed to the same factor. Repeat roentgenograms of the chest showed mediastinal infiltration with pericardial involvement.

A biopsy specimen from the left supraventricular region showed a secondary undifferentiated tumor of a lymph node.

Laboratory studies showed the removed pleural fluid to contain 4 percent solid matter. Repeated cultures of the pleural fluid showed no bacterial growth. The red blood cell count varied between 4.4 and 5.3 million; the hemoglobin from 12.5 to 14.5 grams percent, the white blood cell count from 6,000 to 11,200.

with the average differential count showing 76 percent polymorphonuclear neutrophils, 8 percent eosinophils, 2 percent basophils, and 14 percent lymphocytes. Total serum proteins were 4.45 grams percent. The blood Kahn test was negative. A bromsulfalein test with 5 mg of dye per kilogram revealed 32 percent dye retention in 30 minutes. Sputums were repeatedly negative for acid bacilli. The patient continued to have fever, to lose weight, and became dyspneic. He died 9 October 1948.

*Autopsy.*—Autopsy was limited to the chest. The pleural cavity on the right side contained 1,250 cc and the left 1,200 cc of a bloody coagulative material showing a specific gravity of 1.022. The pericardial sac contained a similar fluid totaling 500 cc. The pleural and pericardial surfaces were studded with white tumor nodules which varied from 4 mm. to 2 cm in diameter.

The lungs, in addition to tumor extending into the lung parenchyma from the hilar regions, showed multiple zones of atelectasis. The mass weighed 1,250 grams.

The tumor had infiltrated around the great vessels entering and leaving the heart. The heart weighed 175 grams. Upon section, the myocardium was atrophic, the left ventricle measuring 8 mm in thickness, the right 4 mm. Tumor infiltration into the myocardium extended beneath the pericardium.

#### DISCUSSION

In case 1, the diagnosis of a melanoma was established prior to death. In this case, the cardiac symptoms and signs occurred after the appearance of the melanoma. It was logical to tentatively consider the pathologic heart changes to be due to a metastatic lesion until ruled out by clinical course or other means.

The diagnosis was confirmed at autopsy; the tumor was so located in the region of the heart that alteration of rhythm would very likely be initiated.

In case 2, surgical observation showed the tumor to extend into the pericardial cavity and when cardiac symptoms occurred it was postulated that myocardial invasion was the likely cause. However, it was not certain that the tumor in the ventricle was responsible for his cardiac condition since the pericardial and pulmonary pathologic changes could well have been the responsible factors.

In case 3, the patient was observed for 27 days. He was known to have a malignancy of the bronchus. His cardiac signs and symptoms were thought to be out of proportion to the degree of arteriosclerosis. The electrocardiogram was of some help in ruling out thrombosis and infarction. With the existing neoplasm and its tendency to metastasize to the myocardium, it was logical to consider the presence of secondary neoplasm of the myocardium in addition to arteriosclerosis. Also considered in the differential diagnosis was mural thrombosis or neoplastic extension via the pulmonary veins. No obstructive phenomenon was demonstrated. The numerous areas of neoplastic infiltration found at autopsy were small and scattered, and conse-

quently these did not alter the electrocardiogram in any appreciable fashion.

In case 4, a diagnosis of pleural involvement by a neoplasm was made on finding neoplastic cells in the pleural effusion and the presence of signs of mediastinal involvement. The exact site of the superior vena cava obstruction was not clear and intra- and extra-pericardial sites were thought to be the best possibility. From the autopsy findings it appeared that both the infiltration of the myocardium and the obstruction of the blood entering and leaving the heart chambers, in addition to the pressure from the pericardial effusion, were factors in the production of his cardiac signs and symptoms.

The cardiac changes which occur following primary and secondary tumors of the heart are similar. No matter which exists, when an infiltrative expanding process is present it produces the same effects.

In an article by Hamilton-Paterson and Castleden (10) pseudo-tumors arising from organization of blood clots and aneurysms, give patterns of cardiac disease not unlike primary sarcoid of the heart. Brick and Greenfield (4) emphasized the view of Scott and Garvin (3) that patients with known malignant neoplasms who have cardiac failure should be suspected of having secondary neoplastic disease of the heart. This sign alone probably outshines all the other findings, including changes in rate, rhythm, and displacements of the segments in the electrocardiogram.

The literature (4) (11) (12) (13) indicates that high-voltage roentgen therapy may prolong the life of the patient as well as relieve the distressing signs and symptoms which may accompany the secondary lesions in the heart.

In the four cases presented the primary lesions were in the bronchus, the skin, and the embryonal tissue of mediastinum. However, the primary lesion may be in any organ; in the majority of cases, the breast and bronchus have been the primary sites. Lung involvement is a common finding when malignant cardiac invasion is present regardless of which organ is primarily involved. The heart may be invaded by direct extension, by lymphatic permeation, or by metastasis. Pericardial involvement is frequent.

Direct extension or lymphatic permeation are the probable routes to the pericardial surfaces. The site of involvement is more important than the extent of involvement in myocardial metastasis, but the extent of involvement seems to be more important in metastatic pericardial lesions.

At this hospital 90 percent of the patients with metastatic lesions of the heart who had no signs or symptoms were unsuspected of having such lesions before autopsy.

The failure to make an ante-mortem diagnosis in cardiac malignancy probably depends on several factors. The symptoms are quite variable and cardiac symptoms may be absent or else sudden as severe heart failure or bizarre arrhythmia may occur. The ample heart reserve, the lack of valvular involvement, and the absence of acute infarction and debility of the patient may not arouse suspicion of a cardiac lesion. Failure of the involved heart may be difficult to detect in patients showing a picture of chronic constrictive pericarditis as reported by Wallace and Logue (14), Fischer (8), Lisa et al. (15). They pointed out that in patients showing evidence of congestive heart failure who are refractory to treatment cardiac tumors should be suspected, especially if there is no obvious cause for cardiac failure.

It is interesting that in our patients the lesions occurred in or extended into the substance of the myocardium. In one patient invasion of the atrioventricular node was demonstrated as the probable cause of arrhythmia. The changes in the electrocardiograms parallel ischemic lesions of the myocardium or extensive scar replacement of the muscle fibers. Mayhaim (16) described a secondary cardiac tumor in which the sino-atrial node was destroyed and rhythm was determined by the atrioventricular node.

Positive diagnosis of metastatic tumors of the heart can only be made on histologic examination of the myocardium. Nevertheless, the possibility of metastasis to the myocardium should be kept in mind. When unexplained cardiac signs and symptoms occur in a patient with a malignant tumor and when little or no cardiac abnormality was previously observed, the ante-mortem diagnosis of secondary tumor of the myocardium can be made with some degree of certainty.

#### SUMMARY

Secondary tumors of the heart are not rare. During a 6-year period they were noted in 8.35 percent of all necropsies performed on patients who had malignant neoplasm.

Any patient harboring a known malignant neoplasm who shows cardiac signs should be suspected of secondary involvement of the heart.

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# Idiopathic Thrombocytopenic Purpura

Splenectomy and Touluidine Blue in Treatment

MARION T. YATES, Commander (MC) U. S. N.<sup>1</sup>

PURPURA is a condition in which hemorrhages or ecchymoses occur in the tissues because of an alteration in the capillaries, or the blood, or both. Capillary alteration has been assumed to be due to defects in the vascular endothelium; the capillaries are either unable to contract when injured or else they are unusually permeable. Recently Humble (1), employing capillary microscopy, has studied the mechanism of hemorrhage in 17 cases of purpura. Five of these were idiopathic thrombocytopenic purpura and in these he found the mechanism to be the same in all cases. In the arteriolar end of the capillary loop, the part from which tissue fluid normally leaves the vessels he observed a shower of red cells hurled from the vessels. No breach of the blood stream in the capillary was evident nor was the capillary obliterated by the pressure of effused blood. He postulates a selective poisoning of this junction.

Other workers believe that thrombocytopenia may be the result of decreased platelet formation, or increased platelet destruction, or increased requirements of platelets. Any factor in the clotting mechanism may be defective; there may be a deficiency of thromboplastin, prothrombin, calcinin, or fibrinogen. Allen and Jacobson (2) indicate that purpura may at times result from hyperheparinemia.

## CLASSIFICATION

The author prefers Murphy's (3) classification of purpura. For the practicing physician it is simple, clear, and workable, and is therefore worth repeating:

1. *Primary purpura (idiopathic, essential)*—The cause is unknown: No associated disease that may be the cause of the purpura is found.

<sup>1</sup>U. S. Naval Hospital, Great Lakes, IL

2. *Secondarum purpura*.—Secondary purpura refers to those cases in which another disease is considered to be the cause.

(a) Secondary thrombocytopenic purpura in which thrombocytopenia is one of the main features. It is seen in myelophthilic anemia, pernicious anemia, the leukemic aplastic anemia, and platelet depression from irradiation, radium or drugs.

(b) Secondary purpura without thrombocytopenia. This condition is noted in:

(1) Acute infections such as cerebrospinal meningitis, measles, scarlet fever.

(2) Toxic or allergic states caused by such agents as quinine, cold salts, barbiturates, mercury sulfonamides, quinacrine iodides, arsenicals, salicylic compounds, pertussis vaccine, estradiol benzoate, blood transfusions.

(3) Constitutional debility such as chronic nephritis, cancer, syphilis, scrofula and other atrophamines.

(4) Septic infections such as subacute bacterial endocarditis, meningococcemia.

Every effort should be made to distinguish the idiopathic from the secondary variety. This is important because the treatment of the two types is very different. Treatment of secondary purpura resolves itself into the treatment of the underlying disease. For idiopathic thrombocytopenic purpura splenectomy is resorted to. It often cures. This operation, even though it has been performed for the past 33 years, still rests on an empirical basis.

#### INCIDENCE

In a series of 90 cases (4) of idiopathic thrombocytopenic purpura the incidence of females to males was 3:1. It was found most commonly in those under 25 years of age (58.9 percent). In this 25-year study only 2 cases were seen in males over 25 years of age.

#### PATHOLOGY

The pathology of secondary purpuras varies with that of the underlying disease. In idiopathic purpura there is thrombocytopenia and hemorrhagic manifestations with a paucity of other significant findings. No constant pathologic change is found microscopically. Nickerson and Sunderland (5) describe the following changes in the spleen: enlargement and activity of the germinal centers, megakaryocytes in pulp sinuses, neutrophilic and eosinophilic leukocytes increased in splenic pulp sinuses.

#### DIAGNOSIS

*Chief features in diagnosis*.—The chief features in diagnosis are:

(a) A great reduction of platelets.

(b) Prolonged bleeding time.

(c) Normal clotting time, but delayed or absent clot retraction.

(d) The red and white blood cell counts are normal, except as noted in differential diagnosis.

(e) A decreased capillary resistance as shown by the tourniquet test: petechial hemorrhages occur over the entire forearm below the level of the blood pressure cuff.

*Differential diagnosis.*—This involves the exclusion of all factors known to cause secondary purpura. In idiopathic thrombocytopenic purpura the spleen is occasionally palpable. However, a very large spleen would make one think of leukemia with purpuric manifestations. Purpura with leukopenia would make one think of aplastic anemia or an aleukemic leukemia. A leukocytosis is found in the presence of secondary infections. Anemia, when present, is not out of proportion to the blood lost.

#### SPLENECTOMY AS TREATMENT

Other than medical management, including repeated transfusions, bed rest, a high-calorie diet, good nursing, symptomatic therapy, removal of foetal infection when found, and use of antibiotics when indicated, splenectomy is offered as the sheet anchor of therapy. The impression is that splenectomy is practically infallible.

Haden (6) states: "Splenectomy in the acute cases should be done if the response to other treatment is not satisfactory. In chronic cases results are excellent."

Krake (7) states that a recurrence was not observed in 9 years at the Emory University Hospital in a series of 23 patients after splenectomy.

Commenting on splenectomy, Downey (8) remarks: "Splenectomy is, therefore, not only a lifesaving but a curative measure in thrombocytopenic purpura which heretofore has been regarded as incurable and accompanied by a high mortality." He reports only one failure in a series of 36 cases (operation successful in 97.4 percent).

It is known that this disease is prone to develop remissions and that the course is so varied that adequate appraisal of any form of therapy will require extended observation. For this reason, both because of the size of the series and the prolonged observation of the cases reported by Elliott (3) it would appear that his findings approach a truer approximation of what one can expect from splenectomy. He reports a 27-year follow-up experience. In a total of 64 cases of idiopathic thrombocytopenic purpura there was a successful result in 69 percent following splenectomy. Breaking this down by age groups, it is found that splenectomy was successful in 95.1 percent of the patients under 31 years of age; results were successful in only 42.9 percent of the patients over age 31 years. The reason for the increased failures of splenectomy in those over 31 years of age is not known.

This difference is important in considering prognosis. Patients under 31 years of age have about a 95-percent chance of cure by splenectomy, whereas those 31 years of age and over have only about a 43-percent chance of cure by splenectomy.

The following is a case report of one patient with idiopathic thrombocytopenic purpura treated with splenectomy and toluidine blue.

#### CASE REPORT

A 19-year old married white man first noted the onset of purpura of the skin, anorexia, and weakness in June 1947. He entered a naval hospital because of frequent occurrence of purpuric areas over his body, repeated moderate nasal hemorrhages, and splenomegaly. The spleen was barely palpable. There was no history of exposure to chemicals or drugs and no history of recent infection. A diagnosis of purpura hemorrhagica was made and on 17 July 1947 a splenectomy was performed. The postoperative course was uneventful. The hemorrhagic manifestations promptly ceased and on 5 September 1947 he went on convalescent leave.

The patient remained well until 15 September 1947 when he noted general malaise. The next day he noted chills and fever and 2 days later was admitted to this hospital.

*Physical examination*—Physical examination revealed a temperature of 102.8° F., pulse, 110; respiration, 28; blood pressure, 110/60. There was crusted blood about the nares. The mucous membranes were pale. Moderate-sized palpable lymph nodes were present in the neck, left axilla, and both inguinal regions. Examination of the lungs revealed dullness, decreased tactile and vocal fremitus, and decreased breath sounds in the left lower lobe. There were a few pin-point petechiae over the trunk.

*Roentgenographic examination*—A chest roentgenogram revealed diffuse mottling with a tendency to follow the bronchovascular markings.

*Laboratory findings*—Urine was negative. Peripheral blood: Red blood cell count, 2.8 million; hemoglobin 10 gm.; white blood cell count, 31,500. The differential blood count revealed myelocytes 2, juvenile cells 2, band forms 3, segmented neutrophils 55, lymphocytes 24, monocytes 4. There were 8 normoblasts per 100 white blood cells. Red cells showed moderate anisochromia and anisocytosis. Platelets were too few for accurate count. Bleeding time, 14 minutes 20 seconds. Clotting time, 4 minutes 20 seconds. Clot retraction, 0 in 24 hours. Fragility test, normal. Blood Kuhn test, negative. Prothrombin time, 95 percent of normal.

Blood chemistry values were within normal limits except for nonprotein nitrogen of 230 mg. per 100 cc. of blood.

Biopsy of sternal marrow revealed count shown in table 1.

*Treatment and hospital course*—The patient was treated with penicillin and frequent whole blood transfusions. Petechiae and ecchymoses recurred periodically. Moderate nasopharyngeal bleeding occurred intermittently. He made a slow recovery and on 17 November 1947 had a remission with cessation of his purpuric manifestations and evidence of normal lungs. His blood picture, both peripheral and sternal, remained essentially unchanged except for improvement in red blood cell count and hemoglobin.

TABLE 1.—*Sternal marrow*

Cell	Normal count <sup>1</sup>	Patient's count	Cell	Normal count <sup>1</sup>	Patient's count <sup>2</sup>
Myeloblasts.....	0.3-5.0	0.4	Basophils.....	0.0-0.7	0
Promyelocytes.....	1.0-8.0	1.2	Lymphocytes.....	3.0-17.0	2.0
Metamyelocytes.....	.....	5.5	Plasma.....	0-2.0	0
.....	.....	.....	Monocytes.....	5-5.0	0
.....	.....	.....	Reticulum.....	2-2.0	0
.....	.....	.....	Megakaryocytes.....	3-3.0	4
.....	.....	.....	Promonoblasts.....	1.0-8.0	3.4
.....	.....	.....	Normoblasts.....	7.0-32.0	14.6
.....	.....	6			

<sup>1</sup> See reference (8).<sup>2</sup> Total.

During this remission adrenalin 1:1000 was used as a diagnostic test to determine the presence of an accessory spleen. Before adrenalin was given, the blood cell count was 4.1 million and the platelets 4,170 per cu. mm.; after the administration of 0.4 cc. of adrenalin, the red blood cell count was 4 million and the platelets 48,000 per cu. mm.

The patient remained asymptomatic until 3 January 1948 when he had hematuria, epistaxis, and slight bleeding from the throat and tongue. He received frequent whole blood transfusions. On 2 February 1948 he had severe frontal and temporal headaches assumed to be due to intracranial hemorrhage. At this time his entire body was covered with petechiae. Transfusions were without apparent effect. Toluidine blue, 2 milligrams per kilo body weight, was given intravenously with no effect on the hemorrhagic manifestations. He died 24 hours later. The body was not discolored by use of the dye.

*Post-mortem examination*—Autopsy revealed extensive hemorrhage throughout the body. The entire body was covered with multiple petechiae. The nose, mouth, gums, and tongue revealed areas of hemorrhage. There was a recent hemorrhage in the left occipital area and an old hemorrhage in the right posterior frontal region of the brain. The lower lobe of the left lung revealed fairly large areas of hemorrhage. The entire gastrointestinal tract was hemorrhagic. There was hemorrhage into the pelvis of the right kidney and massive hemorrhage from the bladder mucosa. No accessory spleen was found.

There was much to indicate that the lymph nodes had assumed the functions of the spleen. Grossly they were slightly enlarged and reddish purple in color. Microscopic sections revealed the capsule to be intact; the peripheral sinuses were filled with blood cells; the architecture of the lymph glands was preserved; and the lymph follicles showed some endothelial proliferation and hyperplasia of the germinal centers. Throughout the entire lymph node there was considerable red blood cell infiltration and a great number of eosinophils.

TABLE 2

	Spleen	Lymph nodes
Size.....	Normal or slightly enlarged	Slightly enlarged.
Color.....	Reddish purple.....	Reddish purple.
Architecture.....	Preserved.....	Preserved.....

<sup>1</sup> Megakaryocytes are few in number and may be missed unless diligently searched for.

The similarity between the spleen of idiopathic thrombocytopenic purpura as reported by Nickerson and Sunderland (5) and the lymph nodes of this patient who had a recurrence after splenectomy is graphically seen in table 2.

#### TREATMENT WITH ANTIHEPARIN COMPOUNDS

Allen and coworkers (2) (10), in 1947, reported studies with toluidine blue and protamines in purpuras. They suggested there was an increase of heparin-like substances in the blood and that these agents rendered heparin inactive, thereby controlling capillary permeability. Toluidine blue was used in doses ranging from 1 to 4 mg per kilo body weight in 250 to 500 cc of physiologic salt solution given intravenously over a 2-hour period. Their patients usually responded in from 24 to 48 hours. In four of their patients acute or subacute leukemia was present and were thus secondary purpuras; in all they obtained beneficial results. In one of their patients idiopathic thrombocytopenic purpura showed a remission after receiving toluidine blue. After refusing further therapy the other patient with idiopathic purpura died.

Parkin and coworkers (11) reported one patient with idiopathic thrombocytopenic purpura treated with protamine sulfate and toluidine blue. Hemorrhagic phenomena continued in spite of administration of 120 mg. protamine sulfate over a period of 4 days and 312 mg of toluidine blue over an 11-day period. They thought this method of therapy was of no benefit in idiopathic thrombocytopenic purpura. Holoubek et al (12) have reported their experiences with the use of toluidine blue in the treatment of purpura associated with thrombocytopenia. One of their patients met the criteria of idiopathic thrombocytopenic purpura, the case histories of two others indicated secondary purpura. The patient with idiopathic purpura failed to benefit from toluidine blue therapy. The two patients with secondary purpura promptly responded to toluidine blue. Holoubek and his coworkers have done toluidine blue titrations on 30 patients with purpural states associated with thrombocytopenia. In this series they have always found the test positive in leukemias. They believe proper selection of cases extremely important.

Our patient treated with toluidine blue received a single injection according to the method recommended by Allen and coworkers (10). He died within 24 hours. Toluidine blue was entirely without effect. After its use the hemorrhagic manifestations did not increase; neither was there any diminution in them. This form of therapy, even when combined with whole blood transfusions, did not prolong life nor did it appear to hasten death. The body was not discolored at time of death.

Antiheparin compounds appear to be of value in secondary purpas. Their value in idiopathic thrombocytopenic purpura is questionable but they should be employed when more conservative methods of treatment fail to produce improvement. To properly evaluate this method of therapy a larger series of cases will be required. With an accurate test for hyperheparinemia (which can be performed by the average hospital laboratory) idiopathic thrombocytopenic purpura may be narrowed down still further.

Much more study of purpura is required. In time easily applied tests to determine the adequacy of all factors in blood coagulation may be found. The therapy of splenectomy still rests on an empirical basis.

#### DISCUSSION

All idiopathic purpas do not respond to splenectomy. Some do not have accessory spleens. Splenectomy is not as successful as the literature indicates it to be. The operation still rests on an empirical basis and why some patients benefit and others do not is not known. Much further study is required to elucidate the problem of purpura.

A rise of the platelet count of 44,000 per cu. mm. after receiving 0.4 cc. of 1:1000 adrenalin is not a positive test for an accessory spleen.

Laloy (13) believes that if a purpura fails to respond to splenectomy there is either an accessory spleen or the case is not idiopathic purpura. Splenectomy failed to cure the case reported. No accessory spleen was found at autopsy. The case meets the criteria of idiopathic thrombocytopenic purpura. Failure of splenectomy may be due to blockage of platelets so that they are not released into the general circulation, to the reticulo-endothelial or lymphatic system assuming functions of the spleen, or to other as yet unrecognized cause. With the present knowledge perhaps it would be better to reclassify idiopathic purpas cured by splenectomy as splenic purpura even though the operation still rests on an empirical basis.

The antiheparin compounds have been most successful in secondary purpas. A reliable readily performed test for hyperheparinemia would put antiheparin therapy on a rational basis in all purpas. It failed to benefit the case reported here.

In the case reported there is evidence to indicate the lymph glands had assumed the functions of the spleen.

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Bonine laboratory studies were within normal limits. The basal metabolic rate was plus 50 on admission.

On transfer to the U. S. Naval Hospital, Seattle, Wash., he was treated with Lugol's solution; a subtotal thyroidectomy was done on 21 January 1946. The pathologic diagnosis was toxic nodular goiter.

The postoperative course was uneventful. He gained 30 pounds, regaining his normal weight. There was some regression of the exophthalmos as determined by exophthalmometer readings. Reported basal metabolic rates ranged from plus 6 to plus 9.

The patient was discharged May 1946, but was readmitted on 10 March 1947 to the U. S. Naval Hospital, Chelsea, Mass., because of difficulty in lid closure. There had been no recurrence of symptoms.



Figure 1.

Examination on this readmission revealed extreme exophthalmos with slight corneal edema. There was no other change in the physical findings except for the presence of bilateral circumcribed pretibial plaque-like tumors which had not been previously noted. These lesions were firm, discrete, plaque-like, oval masses which moved with the skin on palpation. The masses seemed to be definitely cutaneous. There was slight inflammation of the overlying skin and "pigskin" dimpling was evident. The lesions were located in the middle third of the pretibial areas (fig. 1). The right lesion measured 6 cm longitudinally by 5 cm; the left 9 cm by 6 cm.

These masses were first noted in the patient in May 1946. They were bilateral then and had enlarged rapidly to their present size. There were no symptoms referable to the lesions.

Bonine laboratory studies were negative. Blood cholesterol was 208

mg. per 100 cc., basal metabolic rate was minus 4.

A consultant considered the lesions to be bilateral circumcribed pretibial myxedema. A specimen for biopsy from the left pretibial lesion was removed in March 1947. On incision, a glistening, gelatinous fluid oozed from the wound. Microscopic sections revealed a swelling of the connective tissue of the corium. The epidermis was normal, and there was no evidence of inflammation. The interstitial substance was identified as "mucin."

The course during this second hospitalization was uneventful. There was no change in the appearance of the pretibial lesions. The patient was discharged in April 1947. Subsequent follow up has not been possible.

#### DISCUSSION

The importance of the syndrome rests mainly on its rarity and on the fact that the myxedema is consistently pretibial and bilateral and occurs almost invariably in association with thyrotoxicosis.

Bilateral circumscribed pretibial myxedema was apparently not recognized clinically until Watson-William (3) reported the first case in 1895 and mentioned another case so recognized by Hektoen. Another case was reported in 1899 (4) but the condition was subsequently neglected in the literature until a report of a case by Richter (5) in 1927 revived interest. Since then a number of cases have been reported.

Bilateral circumscribed pretibial myxedema is of relatively rare occurrence; only 84 recognizable cases have been found in the literature. However, the incidence is considerably higher than might be supposed if one considers the number of cases unrecognized or unreported. Trotter and Eden (6) reported an incidence of 3 percent in their series of thyroid cases. Dunhill (7) noted a similar incidence.

Conclusions as to the age and sex distribution are impossible because the number of reported cases is too small to be of any statistical significance. There does not appear to be any particular frequency in any one age group as will be noted in table 1. It has not appeared before adolescence and only infrequently beyond the sixth decade. The oldest reported case was 71 years old (8). According to Trotter and Eden (6) there has been no correlation of the age distribution of circumscribed pretibial myxedema with that of thyrotoxic cases in general.

TABLE 1.—Age and sex distribution in 67 cases

Age (years)	Male	Female	Not recorded	Total
Under 20.....				1
20-29.....	4	4		8
30-39.....	5	11	1	17
40-49.....	6	13		19
50-59.....	5	6		11
Over 60.....	2	6		8
Not recorded.....	1	2		3
Total.....	23	43	1	67

Approximately twice as many cases have been reported in women as in men.

Practically all the cases in which race was mentioned were in Caucasians although its occurrence in two Negroes (2) (9), one Chinese (10), and one Dravidian (11) has been reported.

Bilateral circumscribed pretibial myxedema was found closely associated with exophthalmic goiter. Diffuse toxic goiter existed in all reported cases except four in which toxic nodular goiter was present (10) (11) (12) (13).

#### PATHOLOGY

*Gross.*—The changes consist typically of bilateral anterolateral pretibial cutaneous ovoid plaques about 7 cm. in diameter in the lower

Routine laboratory studies were within normal limits. The basal metabolic rate was plus 50 on admission.

On transfer to the U. S. Naval Hospital, Seattle, Wash., he was treated with Lutzol's solution; a subtotal thyroidectomy was done on 21 January 1946. The pathologic diagnosis was toxic nodular goiter.

The postoperative course was uneventful. He gained 20 pounds, regaining his normal weight. There was some regression of the exophthalmos as determined by exophthalmometric readings. Reported basal metabolic rates ranged from plus 6 to plus 9.

The patient was discharged May 1946, but was readmitted on 10 March 1947 to the U. S. Naval Hospital, Chelsea, Mass., because of difficulty in lid closure. There had been no recurrence of symptoms.



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#### PATHOLOGY

**Gross.**—The changes consist typically of bilateral anterolateral pretibial cutaneous ovoid plaques about 7 cm. in diameter in the lower

or middle thirds of the pretibial areas. Considerable variation in size has been reported with the areas of myxedema even extending to the feet or around the ankles. The involved skin has the characteristic "pigskin" dimpling of cutaneous edema although it may be roughly nodular. The skin may be slightly inflamed but not characteristically so. Exudates from incised areas give a positive stain reaction for "mucin."

**Microscopic.**—Microscopically the characteristic pathologic feature is a splitting or dissection of the connective tissue fibers of the corium with interstitial spaces filled with mucin. No inflammatory changes are ever evident and the epidermis is normal.

The pathology of pretibial myxedema has been more fully discussed by Pillsbury and Stokes (2).

The time of onset or discovery of the pretibial lesions in relation to the thyroid disease does not permit any conclusions. In a number of cases the lesions have appeared in the course of recurrent or residual thyrotoxicosis following thyroid surgery. Many of the cases have had the onset of pretibial lesions in an interval of 1 or 2 years after the appearance of thyrotoxicosis or after thyroidectomy. In the majority of cases there is a wide variation in onset—from 1 to 2 weeks (14) to over 10 years (13). Table 2 gives the time of onset of pretibial lesions in regard to the course of the thyroid disease.

TABLE 2.—Onset of bilateral pretibial myxedema in 27 cases

Before the onset of thyrotoxicosis (15)	1
Before treatment for thyrotoxicosis	34
After thyroidectomy	40
After high-voltage roentgen treatment of thyroid	2

Clinically the most striking feature is the unvarying occurrence of pretibial mucin deposition in association with recurrent, residual, or controlled exophthalmic goiter. These features are so characteristic that a clinical diagnosis can be readily made if one considers this syndrome among the diagnostic possibilities. Lymphedema and scleroderma must be considered in the differential diagnosis.

The lesions are rather indolent in their course. They are said to regress and disappear spontaneously over a period of years (2) (6) (7) (13) (14) (15).

As one would expect in an entity whose cause is unknown, treatment has been generally ineffective. Excision of the lesions was tried in one case with presumably a good permanent result (15). Local thyroxin (6) (16), thyroid extract (2) (6), radiant heat (17), iodine (2), and local thyroid implantation (18) have all been tried without apparent effect on the course.

## SUMMARY

1. Bilateral circumscribed pretibial myxedema is an uncommon and not very important clinical entity consisting of bilateral pretibial plaques of mucin deposits occurring in association with a thyrotoxic state, usually exophthalmic goiter. It usually appears in recurrent or residual thyrotoxicosis following surgery.

2. Age, sex, and race distribution and incidence cannot be positively stated because only 84 cases (a statistically insignificant number) have been reported in the literature.

3. The pathologic feature consists of localized cutaneous mucinous infiltration, microscopically identical with that of classical myxedema of hypothyroidism.

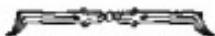
4. In typical cases the diagnosis is readily made clinically. The differential diagnosis includes lymphedema and scleroderma.

5. An additional typical case is reported.

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# Syndrome of Circumoral Pigmentation Associated With Generalized Intestinal Polyposis

## Report of a Case

BEN F. PEERY, Lieutenant, junior grade (MC) U. S. N. R.<sup>1</sup>  
JOSEPH J. ZUSKA, Commander (MC) U. S. N.<sup>2</sup>

LUTCHINSON (1) in 1896 published a report of identical twins who both presented a peculiar pigmentation about the mouth, a fact which was then regarded as a dermatologic osity.

leber (2) in 1919 recorded the death of one of these twins from intussception. Although there was no post-mortem confirmation of intestinal polyposis, it seems likely that these twins suffered from the syndrome to be discussed.

entz (3) in 1921 described a singular family, several members of which showed a strongly suspected or proved generalized intestinal polyposis associated with pigmentation of the mouth, hands, and

Because three generations of this family had intestinal polyps and skin pigmentation a definite familial trend of the disease was apparent. Peutz was the first to report this syndrome.

an Dijk and Oudendal (4) reported the cases of a brother and sister who underwent surgical exploration because of repeated episodes of colic; intussusception of the ileum secondary to small bowel polyps was found. It is to be noted that both the brother and sister had pigmentation of the lips present from birth, similar to that noted in our case.

oster (5) in 1944 published the cases of a father and daughter who suffered from single small bowel polyps complicated by intussception; they also showed characteristic circumoral pigmentation. The father's brother who also had similar lip and facial pigmen-

<sup>1</sup> U. S. Naval Hospital, National Naval Medical Center, Bethesda, Md.



*Figure 3.—Barium enema contrast study showing the presence of a large polyp in the descending colon.*

On admission to this hospital the patient appeared to be normal, well nourished, and well-developed. There was slight inflammation of the pharynx and a postnasal drip. The mucous membrane of the lower lip was diffusely mottled with dark grayish black pigment deposited in patches of varying size (fig 2). These lesions were not elevated. On the skin about the lips there were a lesser number of similar lesions, some slightly elevated. In addition a few pigmented areas were present on the upper lip and some were also present on the oral mucosa. The temperature was 99° F.; the blood pressure 110/70, and the pulse, 82.

Laboratory examination showed red blood cell count, 4,100,000; hemoglobin, 11 gm; white blood cell count 3,500.

On 8 August 1949, a barium enema contrast study showed a polyp, measuring 17×20 mm., in the lower descending colon (fig 3).

On 11 August 1949 a laparotomy was done and a large polyp was excised through an incision in the sigmoid colon. Pathologic examination revealed a benign pedunculated adenomatous polyp measuring 1.5×2.0 cm (fig 4).

The postoperative course was uneventful and the boy was discharged on 20 August 1949.

studies and a proctoscopic examination. When he was between the ages of 7 and 8 years, five or six new rectal polyps were discovered and excised. Again, at the age of 8, another rectal polyp was fulgurated. The patient had no more difficulty until July 1949 when a large polyp of the colon above the rectosigmoid level was revealed by roentgenogram. This necessitated hospitalization and brought the case to our attention. It should be emphasized that the original diagnosis of small bowel polyposis was not made for a period of 3 years after the onset of symptoms, even though the characteristic pigmentation was present from birth. This pigmentation had been noted by a number of physicians who, however, were unaware of its significance.

The family history was entirely negative for gastrointestinal symptoms except for "hemorrhoids" in three persons of the paternal line.



*Figure 4—Section of polyp removed in 1949. (Low magnification.)*

## SUMMARY AND CONCLUSIONS

A case of small and large bowel polyposis associated with a characteristic pattern of circumoral pigmentation is presented. This case is probably a sporadic instance of a syndrome which is usually clearly hereditary and transmitted as a simple mendelian dominant.

This syndrome is not generally appreciated, and when pigmentation of the type described is seen, small and large bowel polyps should be diligently searched for by roentgen studies of the gastrointestinal tract and by sigmoidoscopic examination.

When symptoms of abdominal colic or intestinal obstruction occur in a patient with this distinctive type of circumoral pigmentation, generalized intestinal polyposis should be suspected.

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Following this treatment, epithelialization of the margins with advancement centripetally occurred, leaving a thin, smooth pale, sharply demarcated scar (fig 2). There was no evidence of *C. diphtheriae* in the scars up to 1 month after healing. A moderately severe polyneuritis occurred 3 months after the onset of the cutaneous ulcers. This was manifested by paresthesia of the fingers and toes, fine digital tremors, general weakness, non-clinical fibrillary twichings, hyperesthesia, hypoesthesia decreased vibratory sense, and a spinal fluid protein of 60 mg per 100 cc. A high-calorie, high-protein, high-carbohydrate diet with supplemental vitamin therapy was prescribed. His response was slow, but persistent. There was no known history of exposure to cutaneous or nasopharyngeal diphtheria.

### DISCUSSION

Multiple lesions, as seen in our patient, are reported in 75 percent of the cases of cutaneous diphtheria. Unhealed, indolent ulcers that are severely painful soon after onset but show hypesthesia and anesthesia of the base, margin, and surrounding periphery of the ulcer 3 to 5 weeks after the onset, suggest the diagnosis of cutaneous diphtheria (2). In this case, the presence of severe pain in the ulcers about 8 weeks after the onset conflicts with this diagnostic criterion. The diphtheritic infection in this patient may not have occurred at the time of onset of the ulcerations of the skin, but may have been superimposed several weeks later. If this were true, the nature of the original ulcerations would remain obscure. Myocarditis, proportionate to the severity of the diphtheritic infection and occasionally fatal, occurs 4 to 7 weeks after the onset in a small percent of cases. Our patient showed no evidence of myocardial involvement.

### SUMMARY

A case of cutaneous diphtheria that occurred within the United States, and conformed to the current descriptions of cutaneous diphtheria was complicated by a polyneuritis. The patient responded favorably to local cleansing measures, bed rest, and diphtheria antitoxin. Penicillin was without effect. Indolent ulcers necessitate consideration of the diagnosis of cutaneous diphtheria, even in non-tropical and non-desert climates.

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# Glanders

RALPH W. MENDELSON, Lieutenant Colonel U. S. A. F. (MC)

**G**LANDERS, an acute infectious disease of equines caused by *Malleomyces mallei*, is characterized by ulcerating granulomatous lesions of the skin, subcutaneous tissues, and mucous membranes. The acute cases may become chronic and the chronic cases exhibit acute exacerbations.

In humans it is frequently fatal and often difficult to diagnose unless one is cognizant of the disease when dealing with ulcerating, granulomatous lesions of the skin and/or mucous membranes. The protean manifestations in both the acute and chronic stages may suggest a number of clinical conditions and valuable time may be lost in protecting contacts if a patient with this condition is undiagnosed and thus permitted to spread the infection.

A positive diagnosis cannot be made on clinical findings alone. A history of contact with horses, mules, or donkeys is highly suggestive in a patient exhibiting an ulcerative, granulomatous lesion, particularly of the nose. Syphilis, tuberculosis, epithelioma, and/or a variety of other diseases including granuloma inguinale, lymphogranuloma inguinale, and mycotic lesions must be ruled out.

The following cases were collected by the author and portray the chronic type of lesion. Each patient gave a history of contact with either horses or donkeys. The diagnoses were confirmed bacteriologically. Because of the virulence of the organism it is not advisable to work with cultures except under the most meticulous bacteriologic technique.

## CASE REPORTS

**Case 1.**—A 36 year-old white woman with lesions as shown in figure 1 presented herself for treatment. The past history was irrelevant except for the fact that she had been living on a farm and had been in daily contact with two horses that had died of an unknown disease. She had been treated for a variety of conditions without results. Except for the presenting condition, physical examination was negative. Smears from the nasal discharge and from the ulcers revealed an infection with a gram-negative, slightly curved rod that proved to be

and lips with the formation of extensive scar tissue and deformity. Nasal obstruction was complete (fig 6). There was considerable bilateral adenopathy, but no glandular necrosis. An organism that proved to be *M. mallei* was obtained from the nasal ulcerations; this patient's serum also agglutinated *M. mallei* in very high dilutions.

#### DISCUSSION

The past history in all of these cases reveals that each patient had been in close daily contact with either horses or donkeys and that in every case except one, the animals had died of some unknown disease.

Clinically the lesions may be confused with a variety of conditions. The author has observed, in the tropics, early gangosa that simulated glanders.

The prognosis is not good; the author knows of no specific treatment. Vaccine treatment in case 2 appeared to be of value but one should be cautious in pronouncing a cure as latency is characteristic of the disease.

The nasal passages appear to be the portal of entry for the infection although in one of our cases the eye was apparently the site of the primary lesion.



# Foot-and-Mouth Disease in Mexico

THOMAS G. MURRAY, First Lieutenant, V.C., U.S.A.<sup>1</sup>

THE most serious threat to our cattle today is foot-and-mouth disease, now prevalent in Mexico. Our animal population has suffered from 10 previous outbreaks, the first in 1870 and the latest in 1932. Aside from the present outbreak in Mexico, the cattle-men in Europe, Asia, Japan, Africa, and South and Central America have contended with this malady for many years.

In Mexico the mortality from this disease has been low. In outbreaks in other countries, the animal populations have been more seriously affected. Lesions are usually confined to the mouth, hoof, and udder. After an incubation period of from 18 hours to 1 week, vesicles, that later rupture, appear in the mouth, in the cleft of the hoof, or on the udder. If the tongue is involved there is usually complete loss of the lingual epithelium. However, the stratum germinativum is not affected, perhaps accounting for the rapid recovery in cases without secondary involvement. In many cases infection of the hoofs has been followed by a secondary invasion with *Actinomyces necrophorus*, producing serious lameness.

An outbreak of the disease results in severe economic losses. Milk production is seriously affected in all types of dairy cattle. This disease is highly infective and spreads to entire herds and over large areas. There is no other known disease of animals whose infectivity is greater. An example is the milk shed of Mexico City where at least 50 percent of all dairies were infected. Beef cattle suffer great loss of weight, and may abort. All cloven-hoofed animals—cattle, sheep, swine, and goats—are susceptible. Horses are not affected and there have been no cases in wildlife reported in Mexico.

There are at least three types of foot-and-mouth disease virus—A and O (from the villages of Ardennes and Oise in France where these types were originally isolated) and C. Until recently only type A

<sup>1</sup> Fourth Army Area Medical Laboratory, Fort Sam Houston, Tex.

# Bony Lesions Occurring During The Early Stages of Syphilis

## Report of a Case

John H. Cox Commander (MC) U. S. N.<sup>A</sup>

EVERY physician is familiar with the fact that lesions of the skeletal system, especially destructive osseous lesions, occur during the tertiary stage of syphilis. That this should be true is a little difficult to understand since it is a well known fact that very early in the course of the disease vast numbers of *Treponema pallidum* are widely distributed throughout the entire body, and every tissue in the body harbors the organism (1) (2).

In 1942, Reynolds and Wasserman (2) reviewed the literature and found that 15 cases had been reported. In addition to these, they reported 15 additional cases taken from 10,000 cases which had been observed in the syphilis division of the medical clinic and on the wards of the Johns Hopkins Hospital over a 22-year period (1918 to 1940). Review of the available literature today reveals that theirs is probably the most extensive study of this particular manifestation of the disease which has been made. As early as 1916, Wile and Senear (3), in a study of the involvement of the bones and joints in early syphilis, reported that 60 (36 percent) out of 165 patients with signs of either primary or secondary syphilis also showed signs of bone or joint involvement. Their rather extensive study was completed without the aid of roentgenologic examinations, except in the suspicious cases, and it is entirely possible that a higher percentage would have been discovered had roentgenograms of the bony skeleton been available in all cases. Bloom (4), in June 1934, reported a case of destructive osteitis and facial paralysis in secondary syphilis. His patient apparently had no symptoms referable to the skeletal system until after antiluetic therapy was instituted. Following two injections of bis-

<sup>A</sup> U. S. Naval Hospital, Alameda Heights, T. H.

muth and one injection of neoarsphenamine the patient had pain in the left acromioclavicular articulation over which appeared a tender swelling, and pain on motion of the arm. Roentgenograms showed a destructive lesion in the outer end of the left clavicle. After further antiluetic treatment, healing was demonstrated. Spines and Weiner (5), in 1939, reported a case of osteitis of the skull in early syphilis. They stressed that bone involvement would be discovered more often if roentgenograms were made when patients with early syphilis complained of headache. Newman and Saunders (6), in 1938, reported multiple areas of destruction of the inner and outer tables of the skull in a case of secondary syphilis. They stated that osseous lesions of early congenital syphilis were analogous to those of early acquired syphilis. Every student of syphilology is acquainted with the fact that skeletal involvement is fairly common as a relatively early sign in congenital syphilis. Mandelbaum and Saperstein (7), in 1936, reported a case of acute gummatous osteomyelitis of the skull and the sternum 8 weeks after blood transfusion. Pian and Frazier (8) reported a similar case in 1940. Thompson, Leedham, and Hailey (10), in 1949, reported two cases of osteomyelitis of the skull occurring during early syphilis, each one occurring during the secondary stage of the disease. They felt that trauma might have played a part in determining the location and the subsequent destructive course of the bone lesions. One of their cases also showed a periostitis of each tibia, and the other showed a similar involvement of the right humerus. Interestingly enough, one of these patients was admitted to the hospital for a fracture of the second cervical vertebra, but never showed signs of luetic involvement in this location. The case reported in this article did not give a history of trauma. Likewise, the majority of cases reported in the literature to date have failed to give a history of trauma.

It seems to be almost universally agreed that more cases would be discovered if careful physical examination and roentgenologic examination of the skeletal system were done in all cases of early syphilis. Patients frequently complain of headache during the early weeks of the disease; however, roentgenographic studies are seldom done, unless the patient complains of severe pain. Then, too, because of the dearth of literature regarding this condition it is probable that few physicians are well acquainted with the fact that organic bone lesions, periostitis, arthralgia, arthritis, osteoperiostitis, or osteomyelitis of various parts of the skeletal system can occur during the early weeks or months following the introduction of the causal organism into the body. According to Paucost, Pendegras, and Schaeffer (11), luetic invasion of the calvaria is generally limited to the anterior and lateral portions of the skull, extension being halted by the lambdoid suture.

Destructive gummatous lesions of the skull, the central portion of the face, the tibia, the sternoclavicular region, and the shoulder girdle, occurring years after the primary lesion, are well known to everyone.

#### CLINICAL FINDINGS AND DIAGNOSIS

The diagnosis of destructive bone lesions in early syphilis depends upon an accurately taken history, careful physical examination, and skillfully interpreted roentgenograms. The serologic test is practically always positive. The most frequent lesion seen is a proliferative periostitis of the tibia. Other types of involvement are ostalgia, osteitis, osteoperiostitis and osteomyelitis. Arthralgia and arthritis may accompany the process. The bones most frequently involved in the destructive type of lesions are those of the skull. Pancost, Pendregass, and Schaeffer (11) make the startling statement that few individuals infected with syphilis escape some skull involvement, but, due to lack of symptoms referable to the head, the skull is not often studied. However, any bone in the body might be involved in one of the above-named processes. The most frequent symptoms are pain and swelling at the site of involvement. According to some observers, the pain is worse at night, but, according to others nocturnal pain has been unduly overstressed. Some observers state that for some unknown reason the pain seems to be worse while the patient is in the reclining position. This is questionable. The fact that the patient complains more of pain at night while in the reclining position is possibly due to the fact that his attention is more likely to be attracted to his condition when his mind is relieved of the daily distractions. The patient reported in this article did state that his pain was worse at night. In discussing syphilitic periostitis, Stokes, Beerman, and Ingraham (9) state:

Early syphilitic periostitis, clinically, is a sharply localized process seldom covering more than a few square centimeters and presenting as a somewhat doughy elevation on the bone, noninflammatory, without any sign of fluctuation \* \* \*. Its most distinctive feature is the highly localized point of exquisite tenderness which can be found by searching the entire surface of the tumefaction with the finger tip.

Any sign or symptom of secondary syphilis might accompany these osseous lesions. Bone lesions may occur anywhere from 6 weeks after the primary lesion to 14 months after the appearance of the secondary lesions (2). Several cases have been reported in which rather marked systemic symptoms occurred, including chills and fever, malaise, anemia, weakness, and loss of weight.

#### ROENTGENOLOGY

According to Stokes, Beerman, and Ingraham (9), the importance of skilled interpretation of the roentgenogram is second only to rou-

tine serologic tests for syphilis in establishing the diagnosis of skeletal syphilis. It is agreed that syphilis is primarily a constructive or osteoplastic process. According to Stokes et al. (9), preponderantly constructive bone lesions are usually due to osteomyelitis or syphilis and preponderantly destructive lesions are usually tuberculous or malignant. They also state:

The chief exception to the constructive or productive role in syphilis is in the case of the cranial bones, in which the ultimate destructive process without reconstruction, leaves the diagnosis suspended between syphilis and malignancy. Since primary malignancy of the cranial bones is uncommon, it follows that a destructive process in the cranial bones is, in the absence of primary malignant focus elsewhere, almost surely of syphilitic origin, especially in a patient of precancerous age.

#### TREATMENT

The response to treatment is usually satisfactory and the reversal of the serologic test for syphilis is brought about. According to Reynolds and Wasserman (2), two of their cases apparently were extremely resistant to treatment, but eventually responded after extensive and heroic treatment, including fever therapy and massive arsenical treatment. The Herxheimer phenomenon may occur.

#### PATHOLOGY

Is this particular lesion to be considered a gumma? The answer has to be yes and no. If one adheres to the definition of a gumma, namely, "a soft gummy tumor occurring in tertiary syphilis and made up of tissue resembling granulation tissue," then the answer is "No." However, histologically this lesion is one of bone destruction with round cell infiltration most marked about the blood vessels. In one of the cases reported by Reynolds and Wasserman, a biopsy was done, and a more or less characteristic histologic picture of gumma was noted.

#### CASE REPORT

A well-developed, well-nourished 21-year-old white man was first seen on 20 April 1948 complaining of pain and left-sided headache of about 4 weeks' duration. Coincident with the onset of pain, he became aware of a small, tender swelling over the left frontal region. Roentgenograms of the skull then showed an area of bony destruction, measuring 2 cm. in diameter, located in the left frontal bone just anterior to the frontoparietal suture. A provisional diagnosis of neoplasm of the skull was made and the patient was transferred to a hospital ship on the same day. There physical examination showed: a tender swelling, measuring approximately  $4 \times 2.5$  cm., over the left frontal region and slightly elevated above the surface of the skull; a faint macular rash over the upper anterior thorax; and enlarged, nontender, discrete lymph nodes in the posterior cervical, preauricular, postauricular, and axillary groups.

*Physical examination in hospital*—The patient was later transferred to a naval hospital where the history and physical findings were essentially as given

above except that no rash was noted over the upper anterior thorax as previously described.

*Past history*—According to the record and his story, in December 1947 the patient was treated for gonorrhea with 400,000 units of penicillin, his urethral discharge did not disappear entirely until 10 to 12 days after penicillin therapy had been completed. The patient stated that a blood Kahn test, 3 months after discontinuance of penicillin therapy for gonorrhea, was reported as negative.

*Laboratory examination*—All laboratory studies, including tests for Bence-Jones protein, blood calcium, serum phosphorus, and serum phosphatase, and the tuberculin test were negative. Blood Kahn test, 3+ Spinal fluid examination



Figure 1.—Anteroposterior appearance of skull before treatment (5 May 1948).



Figure 2.—Lateral appearance of skull before treatment (5 May 1948).

tion, normal. Complete urologic study and eye-ground examination revealed no abnormalities.

**Stereoscopic and roentgenographic examinations**.—Stereoscopic examination of the skull showed an area of bone destruction measuring approximately 3 cm in diameter and involving both the inner and outer tables of the left frontal bone just anterior to the left frontoparietal suture. Within the center of this rarefied area there was a zone of normal bone density measuring about 1 cm in diameter (figs. 1 and 2). Roentgenograms of other bones and of the chest were negative.

**Differential diagnosis**.—The following conditions were considered in the differential diagnosis: Primary bone neoplasm; metastatic neoplasm with the primary focus in some other part of the body; hemangio-endothelioma; eosinophilic granuloma; osteomyelitis; mycotic; leprosy; juvenile osteomyelitis; Hand-Schüller-Christian disease; xanthomatosis; osteitis fibrosa cystica; Hodgkin's disease; and leukemic infiltration.

**Darkfield examination**.—It was considered that if the generalized adenopathy was syphilitic in origin, spirochaetes would more than likely be found in the lymph nodes. A lymph node was excised and a scraping, taken from the cut surface, in darkfield examination showed numerous spirochaetes and the typical morphology and motility of *Treponema pallidum* were observed. The destructive bone process, therefore, was considered to be syphilitic in origin, occurring in the early stages of syphilis.

*Treatment.*—Antiluetic therapy was instituted and the patient received the following treatment. From 15 May 1948 to 30 May 1949, penicillin, 10,000,000 units. From 15 May 1948 to 15 January 1949, mapharsen, 25 injections (total of 1.44 gm.), and bismuth sub-salicylate in oil, 25 injections (a total of 3.25 gm.) were given. Simultaneously potassium iodide, 30 drops 3 times a day, was given and continued for 3 months. Additional arsenical and heavy metal therapy were given because (a) skeletal syphilis is generally considered to be one of the more difficult forms of the disease to eradicate and (b) because it would not have been possible to adequately follow the case to determine whether a cure would have been accomplished with penicillin alone.



Figure 3.—Anteroposterior appearance of skull on 7 January 1949 after completion of antiluetic treatment.



Figure 4.—*Lateral appearance of skull on 7 January 1949 after completion of antiluetic treatment.*

Healing of the destructive process occurred approximately 8 months after beginning antiluetic therapy (figs. 3 and 4). The blood Kahn test was reported negative December 1948, 7 months after antiluetic therapy was started.

#### DISCUSSION

The patient's blood Kahn test was negative when he entered the service in September 1945. In December 1947, he had gonorrhea which was treated with 400,000 units of penicillin—adequate therapy for the majority of cases of gonorrhea, but certainly inadequate for early syphilis although perhaps enough penicillin was given to mask the development of full-blown secondary syphilis. Since his urethral discharge did not clear up for 10 to 12 days following therapy for gonorrhea, that probably was indicative of the presence of an intraurethral chancre at that time. The macular rash over the upper anterior thorax before his admission to the hospital could easily have been an abortive secondary eruption.

#### SUMMARY AND CONCLUSIONS

A case of destructive syphilitic osteomyelitis of the skull occurring during the early stages of the disease is reported. A review of the literature shows that surprisingly few cases of this particular mani-

festation of the disease have been reported. Experts in the field have stated that more cases would probably be discovered if more careful physical examinations and roentgenologic studies were done during the early stages of the disease.

It has been suggested that bone involvement in early acquired syphilis is analogous to skeletal lesions commonly observed in the congenital form of the disease.

A very useful and practical method of making the diagnosis of syphilis is by lymph node aspiration or by lymph node excision and darkfield examination of the lymph node juice. This is especially true when skin or mucous membrane lesions are absent.

A plea is once more made to physicians who are charged with the responsibility of treating gonorrhea with penicillin to adequately follow such patients for a sufficient time, at frequent intervals, by physical examination and blood tests to rule out the possibility of a simultaneous luetic infection. Monthly physical examination and blood tests for at least 6 months after the completion of penicillin treatment of gonorrhoea is considered necessary.

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# Fractures of the Mandibular Condyle

## Report of Eight Cases

CAESAR FASTIGGI, Captain, D.C., U. S. A.<sup>1</sup>

FRACTURES of the mandibular condyle are not so common as those which occur in other parts of the mandible. However, they are not so rare as was believed at one time. Their greater frequency may be attributed, at least in part, to the increased prevalence of automobile and industrial accidents. Furthermore, the later roentgenographic equipment and techniques now used show these fractures more clearly. Clinical statistics show that about 8 percent of mandibular fractures occur at the condyle.

### ANATOMIC CONSIDERATION

The temporomandibular joint is complicated in that it is made up of the roller-shaped head of the condyle, the interarticular disk, known as the meniscus, and the mandibular or glenoid fossa. The fossa is bounded anteriorly by the articular eminence, and posteriorly by the postglenoid tubercle. The wall of the temporomandibular joint is a loose, thin capsule which surrounds the cartilaginous articular portion of the mandibular fossa and articular tubercle, and inserts in the area of the upper condylar neck. The joint cavity is divided into two chambers by a specialized disk of fibrocartilage which unites peripherally with the capsule and anteriorly with the insertion of the external pterygoid muscle. Laterally, the joint capsule is reinforced by the heavy bands of the temporomandibular ligament extending posteriorly and inferiorly from the zygomatic arch to the lateral and posterior surface of the condylar neck.

The slinglike action of this ligament is important in normal joint function. Medially, the capsule is thin and not well-supported. Rupture at this site with medial dislocation of the condylar head is frequently seen in fracture of the condyle. The stylomandibular and

<sup>1</sup>Post Dispensary, South Post, Fort Myer, Va.

sphenomandibular ligaments are of less importance; they aid in maintaining the mandible in place when a fracture occurs. Overriding of the fragments frequently follows condylar fractures. This condition results from the powerful upward contraction of the masseter, internal pterygoid, and temporal muscles. The external pterygoid muscle plays an important role in the displacement that occurs in condylar fractures. This muscle has its insertion in the neck of the condyle and because of its anterior pull tends to displace condylar fractures anteriorly. Some of the superficial structures in proximity to the condylar process are the parotid gland, auriculotemporal nerve, superficial temporal vessels, and branches of the facial nerve. The internal maxillary artery and pterygoid venous plexus are important structures deep to the condyle.

#### CLASSIFICATION

Condylar fractures have been classified by Thoma (1) as follows:

1. Fractures without displacement.
2. Fractures with displacement.
3. Fractures with overriding of the fragments.
4. Fracture dislocations (medial or lateral).
  - a. Intracapsular fracture dislocations (subluxation).
  - b. Complete fracture dislocation.
  - c. Fracture dislocation with complete dislodgment of the condyle.
  - d. Dislocation of part of the head of the condyle.
5. Fracture dislocation in forward direction.
6. Fracture dislocations with displacement of the meniscus.
7. Comminuted condylar fractures.
8. Old condylar fractures with deformity.

#### ETIOLOGY

The cause is direct or indirect external violence. The fracture usually occurs as a result of a blow on the chin. If the blow is on the side of the chin, the opposite condyle is usually involved. In bilateral fractures, the blow is often on the point of the chin.

#### CLINICAL FINDINGS AND DIAGNOSIS

The clinical signs of fracture of the mandibular condyle may be scarcely perceptible and symptoms may be negligible or absent. Frequently the roentgenogram gives the first evidence of a condylar fracture. Varying combinations of signs and symptoms may be present, and there is no correlation between the extent of fragment displacement and the magnitude of clinical deformity. In spite of the displacement seen in roentgenograms, there may be no occlusal im-

balance or functional disturbance. Fractures with minimal displacement are usually unaccompanied by great deformity or functional disturbance. On palpation of the area in front of the ear in absence of normal excursion of the condylar head will be found on the side of the fracture. Palpation of this area may reveal crepitus. If there is no associated edema, gross displacement of the condylar head may be disclosed by palpation. Pain may be present in front of the ear with an increase in tenderness during excursion of the jaw.

Disturbance in the occlusal relationship of the teeth is commonly present. Fractures complicated by overriding shorten the distance between the angle and the mandibular fossa. In unilateral fractures the posterior teeth on the affected side are brought into premature contact, thus producing an open bite on the opposite side in the molar region. Frequently a retro-inclusion of the posterior mandibular teeth is found on the affected side. When the mouth is open, the distance between the occlusal surfaces is less on the affected side than on the normal side. The chin will also be displaced toward the affected side. Bilateral condylar fractures with upward and posterior displacement of the mandible produce premature contact of the posterior teeth and an open bite anteriorly; in such cases, protrusive excursion of the mandible is impossible. An important method of diagnosing these fractures is to place the index fingers in the auditory canals. Normally, the condyle can be clearly felt here when the mouth is opened and closed. When a fractured condyle is dislodged from the mandibular fossa, these movements are less distinct. When it is dislodged from the capsular ligament, the movement cannot be felt at all. Hemorrhage from the ear may mean that the fractured condylar head may have fractured the tympanic plate. This can be very serious.

#### TREATMENT

The treatment of condylar fractures must be based on diagnostic facts. Accurate roentgenograms showing the fracture line and positions and relations of the fragments are important to the study of the problem. The condition of dentition, disturbance of occlusion, and dysfunction of the mandible during excursion must be considered in planning the treatment. Since condylar fractures are commonly associated with other mandibular fractures, combined evaluation and management are often necessary. The aims of treatment in all mandibular fractures are the restoration of normal function with correct occlusion, or correct interarch relations if the patient is edentulous, and the elimination of the associated deformity. Early reduction and immobilization favor a satisfactory result.

*Closed reduction.*—Closed reduction and immobilization is a form of treatment that has many modifications varying with the specific

problem. If there is little or no displacement and relatively free movement of the mandible, early immobilization by some form of intermaxillary fixation is advocated for 3 to 5 weeks. When displacement or dislocation is evident, an attempt at reducing the condylar fragment is indicated before immobilization. This is particularly important if excursions of the mandible are blocked by the malposed condylar head. Reduction may be attempted by bimanual manipulation extraorally and intraorally. If overriding is present, downward traction on the ascending ramus will permit the return of the condylar fragment to a more normally functioning position. Such manipulative procedures are more efficacious if a general anesthetic is administered to the patient, because displacing forces are released by complete muscular relaxation. When there is overriding of fragments, resulting in an anterior open bite, the muscle spasm may be gradually overcome by anterior intermaxillary elastic traction. With this procedure the posterior opposing teeth act as a fulcrum, while the anterior bite is closed and normal space is restored for the overriding fragments. This principle is employed in the use of posterior bite plates, blocks, and appliances in edentulous posterior areas in order to increase the fulcrumlike action. With the relaxation of the muscles of mastication and restoration of adequate joint space, the condylar fragment may be reduced to a more normal position. The goal of manipulative procedures in such cases is not an accurate anatomic coaptation of fragments but an approximate alignment which does not inhibit mandibular excursions.

The type of immobilization and period of fixation are variable phases of conservative treatment. After manipulative reduction, and assurance that mandibular excursion is not blocked by condylar displacement, some form of fixation may be applied. Among the appliances used for intermaxillary fixation are (a) direct interdental wire ligation (b) wire lug-forming devices of the Stout or Riedel type; (c) buttons; (d) arch wires, and (e) splints provided with lugs for intermaxillary elastic traction. Each of these appliances is specially designed for a specific type of case. Care must be exercised to minimize irritation to soft tissues and to prevent unbalanced displacing forces on the teeth. The most satisfactory appliance is that which distributes the forces of traction evenly over the supporting dentition with the least damage to periodontal structures. It is generally agreed that fixation should be applied as soon as possible after manipulation of the mandible has restored normal closed occlusion. Closed fixation may be delayed temporarily from 24 to 48 hours while intermaxillary elastic traction produces the desired reduction. Incomplete fixation has been advocated by those who contend that fragment mobility will prevent threatened ankylosis. Early limited excursions are encour-

aged in order to establish a flail joint or pseudarthrosis. According to this concept, an adaptive balance of the muscles of mastication permits adequate functional excursions in such a condition. This principle is preferred by some British authorities for treatment for unilateral condylar fractures. Cap splints which embrace training flanges are frequently cemented to the teeth for guidance of the mobile mandible to proper occlusion.

The management of bilateral fractures of the condyle does not differ significantly. Since typical posterior displacement of the mandible and anterior open bite are often extensive, early and complete reduction and immobilization are advantageous in preventing serious deformity. Sometimes anterior and superior traction may be applied by intermaxillary elastics. When reduction is complete, immobilization is established and maintained for the desired period. The period and degree of fixation will vary with the patient and with the viewpoint of those in charge.

Intracapsular fracture of the condylar head is relatively rare and difficult to demonstrate. Some authorities have designated intracapsular fractures involving articular joint surfaces as those most vulnerable to ankylosis. Treatment by conservative methods is essentially the same as that in other condylar fractures. Since fractures of the condyle are so frequently associated with other mandibular fractures, intermaxillary fixation provides a combined form of treatment. Under these conditions, a compromise must be made between the ideal fixation periods for each fracture. It is considered advisable to continue observation of patients with condylar fracture for 4 to 6 weeks after discontinuing fixation. Minor adjustments in articulation of the teeth may be indicated and are readily made by selective grinding.

*Open reduction.*—In recent years open reduction of fractures of the condyle has been advocated by those who believe that dislocation and appreciable displacement are indications for surgical intervention. The procedure has ranged from reduction through a simple intraoral or extraoral incision to a complex visual reduction with transosseous wire ligation of fragments in exact anatomic relation. The intraoral approach employs a vertical incision 2 cm. long from the tip of the coronoid process inferiorly along the anterior border of the ascending ramus (2). Soft tissues are reflected from the medial surface, and a urethral sound is inserted to engage the medially displaced fragment and reduce it laterally by lever action. The buccal maxillary tuberosity serves as the point of the fulcrum. When the condylar head is reduced, intermaxillary fixation is applied. A similar manipulative procedure may be performed with a small hook through a short horizontal preauricular incision just inferior to the zygomatic arch (3).

Difficulties are encountered in performing a complete open reduction and fixation. Through a vertical preauricular incision, adequate visibility and exposure are difficult; in a small, deep field one must accomplish a difficult technical procedure without damage to such important adjacent structures as the internal maxillary artery, branches of the facial nerve, and the temporomandibular joint capsule; fixation is laboriously complex with this approach. Wire ligation through holes drilled in the approximated fragments is sometimes considered ideal fixation. In selected cases, external pin fixation has been used to supplement internal wiring. Pins are inserted just below the condylar head and into the temporal zygomatic process. More radical surgical management employs condylectomy in cases involving wide displacement and dislocations. Several unsuccessful attempts at open reduction have necessitated condylectomy.

All methods of open surgical reduction are combined with some form of intermaxillary fixation. Patients are selected for open reduction when it is considered that they will not respond well to a closed procedure. Advocates of the open procedure emphasize various complications such as ankylosis, traumatic arthritis, limited motion, and malocclusion that may arise when the closed method is used. They suggest that we are not aware of these complications because clinical cases that have been reported were managed by conservative methods and have not been followed closely for years after treatment.

Ivy (4), Berger (5), and many others have stressed the fact that without realignment of fragments, condylar fractures under conservative treatment attain satisfactory functional results. Open operation has not been widely used for many reasons. There are numerous types of condylar fracture in which open reduction and fixation is a technical impossibility. The procedure predisposes to many complications. The fracture is made compound by the procedure, and additional invasion of, and trauma to the joint capsule foster crevicular processes and ankylosis. Surgical intervention is dangerous because of the proximity of the fracture to several important structures. Direct wiring and pin fixation induce trauma and introduce foreign material, thereby inviting infection and necrosis. Most authors, therefore, prefer the closed reduction technique. Thomé is the greatest advocate of the open reduction method. He has observed satisfactory results in many patients. Other writers, however, cite many more that were treated conservatively with excellent results (3).

In reviewing 155 case histories, I found that about 145 of them were treated conservatively and the remainder by different types of open reduction. I was surprised to find that the patients treated conservatively obtained excellent results, even when displacement was present. The following are some recent case histories of fractures of the man-

*Case 3.*—The patient was sent to the dental clinic with a diagnosis of a fractured mandible. The fracture had occurred 1 week previously. Examination disclosed an edentulous upper arch with a full denture in place. The lower molar teeth were missing. There was a deviation from the normal occlusion and pain in both temporomandibular areas when the mandible was moved. Roentgenograms disclosed simple, complete fracture of the right mandible at the mental foramen, and at the neck of the condyle, and simple, complete fracture of the left mandible at the neck of the condyle with medial displacement from the glenoid fossa. Occlusion was re-established to the upper denture and the lower jaw was stabilized by means of a head cap and flexible collection chin plate attached by elastic traction. After 8 days the occlusion was normal and no pain was felt when the jaws were opened. Two weeks later all stabilizing aids were removed. There was good bony union but the denture was no longer satisfactory and the patient required new complete upper and partial lower dentures.

*Case 4*—The patient was sent to the dental clinic with roentgenographic evidence of simple, complete fracture of both mandibles at the neck of the condyle, with displacement, and simple, incomplete fracture of the symphysis of the right mandible. Intramaxillary continuous wire loops were applied, the fractures were reduced, and elastic traction was applied. L-12 was fractured and extracted. A good result was obtained.

*Case 5.*—The patient was brought to the dental clinic following a jaw injury. Examination disclosed a deviation to the left when opening the mouth. There was swelling anterior to the tragus of the left ear and pain on palpation. A diagnosis of simple, complete fracture of the left mandible at the neck of the condyle was made. Roentgenograms confirmed the diagnosis and showed the head of the condyle to be displaced medially from the glenoid fossa. Intramaxillary wiring was applied with intermaxillary elastic traction to re-establish the normal

relationship of the teeth and jaws. The patient was seen daily for irrigation of the oral cavity and adjustment of the tractor. After 2 weeks there was very little loss of function and no further treatment was deemed necessary, although because of nonunion it was believed that resection might become necessary later. After 23 days all traction was removed. Function was excellent and the patient had no pain or discomfort.

**Case 6**—The patient was sent to the dental clinic because of a fracture of the mandible which had occurred several days previously. Examination disclosed a fracture of the symphysis of the mandible with distal displacement of the right side signifying probable fracture of the condyles. The maxilla was slightly mobile, but was not displaced. Roentgenograms disclosed (a) compound, complete fracture of the symphysis of the mandible, (b) simple, complete fracture of the neck of the condyle of both mandibles, and (c) fracture of the maxilla with cicatrical tissue union and no displacement. Impressions were obtained for the construction of a splint. Penicillin in doses of 300,000 units daily was given for 5 days. On the third hospital day the fractures were reduced and the splint applied. Intramaxillary wiring was applied to the maxillary teeth and occlusion was established with elastic traction. One week later the occlusion was normal. Thirty three days after traction was applied it was removed. Roentgenograms taken at that time showed good alignment of the fractures and some callus formation. Seventeen days later the splint was removed. The occlusion was adjusted to provide a better cuspal relationship. There was no deformity or loss of function.

**Case 7**—The patient reported to the dental clinic with injuries received 2 days previously. Examination and roentgenograms disclosed (a) compound nonminuted fracture of the maxillary alveoli from L-3 to R-5, (b) fracture of the teeth L-1, R-1, R-2, R-3 and R-4, (c) compound fracture of the anterior one-third of the palatine bones with posterior displacement, (d) complete, compound fracture of the left mandible in the region of the mental foramen, and (e) fracture of the neck of the condyle of the left mandible displacing the condyle medially out of the glenoid fossa. The mandible was manipulated under local anesthesia in an attempt to replace the condyle without success. The fractured teeth were extracted and the loose pieces of alveolar bone were removed up to and including the anterior concave portion of the vomer. Hemorrhage precluded the removal of two root tips of R-4 at this time. The palatine bones attached to the mucoperiosteum of the palate were placed in position and the soft tissues were sutured. Impressions were obtained for a maxillary splint. A gauze pack was then placed against the palate and held under pressure by wires from the bicuspid teeth. Continuous loop wiring was applied to the mandibular teeth. A head bandage was then applied to stabilize the jaws and the patient was returned to the ward. After 3 days the upper splint was applied. Traction was placed so as to create space for the condyle to be returned to the glenoid fossa. Two days later it was apparent that the condyle was not being reduced, so normal occlusion was established and elastic traction was applied to maintain this position. The patient was seen daily for irrigations of the oral cavity and adjustment of the tractor. Two weeks after traction was applied it was removed and 2 days later the splint was removed. The vertical opening was excellent as were the left lateral and protrusive excursions. There was limitation of the right lateral excursion. There was apparently no impingement on any nerves by the misplaced condyle. On the next day the residual roots were located and removed, and 3 days later all wiring was removed. It was estimated that 6 more weeks would be required before an upper partial denture could be made. The left

## SUMMARY

Fractures of the condyle have been classified according to the displacement or dislocation of the condylar fragment. The prime objective of treatment is the restoration of normal function and the elimination of any associated deformity. Conservative methods of reduction and intermaxillary fixation are simple and effective.

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patients he had seen in the current epidemic in Japan. He recommended discontinuing the sulfadiazine because of the danger of renal damage and that the patient be removed to a general hospital for observation for a brain abscess. It was believed that the intensive intrathecal therapy with penicillin contributed to her fever, increased her spinal fluid cell count, and produced signs of meningeal and central nervous system irritation.

### DISCUSSION

*Absorption rates of penicillin given intramuscularly.*—Early clinical investigation has revealed that parenteral administration of penicillin does not result in its excretion into the subarachnoid space of normal persons in bacteriostatic concentrations (1) (10). Some penicillin was found in the cerebrospinal fluid 31 hours after parenteral injection but not in effective concentration (11). It was absorbed more readily and produced higher concentrations when given parenterally in patients with meningitis if the infection was acute (12). In patients with chronic low-grade meningitis, parenteral injections did not result in effective concentrations of the drug in the cerebrospinal fluid (11). In those with acute meningitis, a bacteriostatic level of penicillin in the cerebrospinal fluid could not be attained for more than 1½ hours by parenteral administration. To attain such levels, large amounts (500 to 5,000 units per kg. of body weight) were required and even then the levels obtained were quite variable (13). There was no assurance that the patient would attain a beneficial titer of the bacteriostatic agent in the cerebrospinal fluid, since the absorption of the same amount was unpredictable after repeated administrations. Thus, direct instillation of penicillin into the subarachnoid space was necessary if high levels were desired in treating infections of the meninges caused by susceptible organisms.

*Dosage schedules recommended.*—It was noted early in the literature that administration by such a route would result in harmful reactions. In 1944 a report appeared suggesting that penicillin had detrimental effects on the central nervous system after intrathecal instillation (3). Prior to this, Rammelkamp and Keefer (1) advocated that penicillin be given intrathecally, but in dosages not exceeding 3,000 to 5,000 units daily because of the possible occurrence of pleocytosis in the cerebrospinal fluid after large doses.

Other writers recommended intrathecal doses of never more than 10,000 units daily, but reports again began to appear showing that penicillin was being used in larger amounts (3) (14). Each report illustrated that penicillin acted on the meninges as an irritating foreign body and produced many undesirable effects. The lowest reported intrathecal amount to cause signs of meningeal reaction was

18,000 units (3) (15). The largest amount recorded as having been used in a single intrathecal injection was 300,000 units (16). This was followed by symptoms compatible with severe adhesive arachnoiditis, which was later proved at craniotomy.

*Specific toxic reactions in man.*—Although the previously mentioned cases and an increasing number of others have appeared in the literature in the past 5 years, it appears to be necessary to call attention to the reactions that occur when the drug is used intrathecally. These reactions have included: (a) damage to the cauda equina and spinal cord (17); (b) flaccid and spastic paralysis of the extremities (15); (c) status epilepticus (18); (d) adhesive arachnoiditis (16); (e) transverse myelopathy (6); (f) sacral radiculitis (8); (g) convulsive seizures (18) (19) (20); (h) optic atrophy (3); (i) general signs of meningeal irritation (2) (4) (7) (9) (21); and (j) pleocytosis of the cells in the spinal fluid (5) (22). The symptoms and signs that may be produced are shown in table 1. Most of the experimental work has been done on the convulsive effects of penicillin given intrathecally (19) (23) (24). The effective bacteriostatic agent in penicillin is itself responsible for the convulsions produced. Certain impurities that cause pyrogenic reactions do not appear to cause the convulsions.

Whether the convulsions that occurred in our case could be attributed directly to the use of the drug or whether they resulted from the febrile reaction cannot be definitely stated, but it would appear that the penicillin was a contributing factor.

TABLE 1.—*Symptoms and signs following intrathecal administration of penicillin<sup>1</sup>*

General:	Neurologic:
Fever.	Convulsions.
Headache.	Paresthesia.
Irritability.	Facial nerve palsy.
Listlessness.	Loss of speech.
Cardio-respiratory:	Nuchal rigidity.
Vascular collapse.	Paralysis of extremities.
Irregular respiration.	Muscular fibrillation.
Gastrointestinal:	Muscular spasm.
Nausea.	Signs of pyramidal tract irritation.
Vomiting.	Incontinence of urine.
	Abnormal electro-encephalogram.
	Pleocytosis and increased globulin
	in the spinal fluid.

<sup>1</sup> Adopted from Morganson (21).

#### CONCLUSIONS

1. The safest dosage of penicillin given intrathecally appears to be not over 10,000 units daily.

2. Toxic reactions are to be expected if dosages above this level are used.

3. Penicillin should not be used intrathecally unless specifically indicated.

4. It is apparent that the stormy clinical course in the case reported was caused by the repeated intrathecal administration of penicillin. There was no sound indication for the intrathecal administration of penicillin in what was presumably preparalytic poliomyelitis.

Kraut-Stots

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# Mosquito Control Problems in Japan

WALTER J. LACAS-E, Major, U. S. A. F. (MSC)<sup>1</sup>

**M**ALARIA, filariasis, dengue, and Japanese encephalitis are the mosquito-borne diseases of man known to occur in Japan.

Malaria was not a reportable disease in Japan prior to Allied occupation and the information available on its incidence and distribution does not permit accurate evaluation of the problem over a period of years. The statistics compiled by the Public Health and Welfare Section, Supreme Commander for the Allied Powers, show about 11,000 cases of malaria among the Japanese in 1947, and 4,752 cases in the first 11 months of 1948. Cases were reported from all Prefectures of the country in both years for which complete records are available. About one-half of the cases reported in 1948 occurred in Shiga Prefecture in south central Honshu and the remaining cases reported showed a rather even distribution throughout the four principal islands. This distribution strongly suggests that, except for Shiga Prefecture, a large number of cases of malaria are occurring among repatriates and returned Japanese soldiers who contracted the disease elsewhere. This conclusion is further supported by the fact that the total number of cases reported in 1947, when repatriation was continuing at a high level, was more than double the number reported in 1948. All information at hand supports the contention that malaria does not constitute a significant public health problem in Japan.

No significant filariasis surveys have been conducted among the Japanese to date by Allied Medical Department personnel. In three separate areas on south central Honshu, malaria survey detachments made about 1,000 thick smears on adults and in this series only 1, that of a Chinese who had resided most of his life in southern Malaya, was positive for filariasis. The latest extensive surveys performed by

<sup>1</sup> 207th Malaria Survey Detachment.

Japanese workers were made in 1926 among soldiers of the Japanese Army. Endemicity for filariasis in the latter studies varied from 0 to 2 percent in Prefectures in the southern half of Honshu while on the southernmost island of Kyushu, infection rates varied from 0.5 to 12 percent in the Prefectures in which surveys were made. The highest rates recorded were along the western and southern coasts of Kyushu. More up-to-date surveys, accomplished under carefully controlled conditions are in order at present and a new appraisal of the problem would be the only basis on which to evaluate the relative importance of this disease from a public health point of view.

According to Japanese informants, dengue was unknown in Japan prior to 1942. There is no evidence to back this claim other than a record to this effect contained in an unpublished paper made available by a member of the teaching staff at Kyoto University. Data enumerated here were obtained from the latter source. In 1942 an epidemic of about 13,000 cases of dengue occurred in Nagasaki, Kyushu, and in 1943 over 10,000 cases were recorded in the Kobe-Osaka-Kyoto area in south central Honshu. In 1944 and 1945 fewer cases were seen and these were also limited largely to the epidemic area of 1943. No cases have been recorded in Japan since 1945. Dengue outbreaks from 1942 through 1945 were of about 7 weeks' duration beginning in late July and terminating shortly after mid-September. The benign nature of this disease and the present lack of evidence of its actual establishment on these islands serve to relegate it to a secondary position in the mosquito-borne disease problem.

From the standpoint of case incidence, severity, and geographic distribution, Japanese encephalitis is the most important mosquito-borne disease in Japan. Outbreaks that were probably Japanese encephalitis date back to 1871, but the first large epidemic on record occurred in 1924. Over 6,000 cases were recorded in that year. Another epidemic involving over 5,000 cases occurred in 1933, followed by the largest outbreak on record in 1948 with 8,023 cases and 2,455 deaths, giving a case fatality rate of about 30 percent while the case fatality rates in previous epidemics ranged as high as 60 percent. In the years between 1935 and 1948 the incidence varied from a few cases to 2,800 with some cases occurring almost every year. About 33,000 cases are on record from 1924 through 1948. The figures quoted make no allowances for patients who may have been misdiagnosed.

In the 1948 outbreak there were 30 cases of the disease with 5 deaths among occupation personnel. No figures showing the occurrence of the disease in immunized persons were available. This disease appears regularly from year to year in the south central portion of Honshu in the inland-sea area, and while it occurs particularly in epidemic

years in all islands of the archipelago it is rarely seen in the northernmost island of Hokkaido. Serologically it can be shown that a large proportion of the indigenous population has had experience with the virus. It is estimated that the ratio of clinically recognizable cases to inapparent infections is between 1:300 and 1:1000. Thus, we have a disease that is practically nation-wide in distribution, a fact which is important in considering mosquito control as a means of protecting the population.

#### IMPORTANT VECTORS

There are about 50 species of mosquito in Japan but of this number not more than 8 are important from the standpoint of their feeding habits. Among those which feed on man readily are *Culex pipiens pallens*, *C. tritaeniorhynchus*, *C. bitaeniorhynchus*; *Aedes albopictus*, *A. flavopictus*, and *A. vexans nipponii*, all of the latter being important day-biting mosquitoes. *Anopheles hyrcanus sinensis* is the only important anopheline and is the vector of malaria in Japan. In certain sections of the country a representative of the genus *Mansonia* occurs and it is a severe pest in the localities where it is established.

Japanese workers claim to have isolated the virus of Japanese encephalitis from *C. tritaeniorhynchus* in nature and the evidence at hand points to this species as the principal vector of the disease. *C. pipiens pallens*, a closely related species, is claimed, on the basis of studies carried out by Japanese, to carry the virus in nature and its habits and seasonal incidence strongly incriminate it as a possible vector. *A. albopictus* is the most likely vector of dengue. Filariasis may be transmitted by any of the mosquitoes which feed on human beings since the entire group has been proved experimentally to be capable of transmitting this disease.

The composite list of breeding sources of mosquitoes that readily feed on man in Japan is most impressive and emphasizes the difficulty of control. Most important species live in close proximity to human habitation and practices associated with agricultural pursuits create a large proportion of mosquito-breeding habitats. An understanding of the basic problem entails a knowledge of local agricultural practices. Rice constitutes the principal agricultural crop of the country. The rice paddies are flooded in June and remain under water throughout the breeding season of the important species of mosquito. In addition to the paddies, rice-growing districts are heavily interlaced with a system of drainage and irrigation ditches containing stagnant or slowly moving water. Night soil constitutes a large part of the fertilizer employed in growing crops and the tanks used for storing it dot the landscape wherever crops are grown. In the application of night soil as fertilizer large quantities of water are used. Thus

we have a large portion of the land under water and productive of some mosquitoes through the summer months, mosquito-producing rice paddies in abundance, and night-soil storage and garden-irrigation tanks scattered throughout the rural areas serve to further augment the mosquito population. To these can be added poorly constructed roadside ditches, gutters, and, occasionally, extensive unclaimed marshy areas. A few of the smaller breeding sources include innumerable artificial containers such as drums, bowls, buckets, cans, urinal crocks, flower pots, decorative stone vases, native latrines, cisterns, water-holding rubble in bombed areas, and the stumps and posts of cut bamboo. Thus we have a diverse and extensive breeding problem presenting a difficult approach from a control standpoint.

Temperature and rainfall have a determining influence on mosquito propagation. The daily high temperature normally reaches 70° F. about the beginning of May in all areas of Japan south of Tokyo, at or near sea level. There is a gradual increase in daily mean temperatures from May to late June at which time daily high readings are between 80° and 85° F. In early July daily temperatures reach 90° to 95° F. and this level is maintained to the end of August. June and September are usually the wettest months but there is no true wet or dry season in Japan. Seasonally the first heavy impetus to propagation of mosquitoes is given by the higher temperatures attained in the latter part of June coupled with heavy precipitation occurring in that month. There is a steady upward climb of the density curve of biting species through July with a peak usually attained by mid-August. A great decrease in mosquito density occurs in the latter part of August and with the onset of cooler weather in September the density quickly approaches zero. The mosquito-control program requires close attention in the field from about mid-May through mid-September in the area extending south from Tokyo. A mosquito-control program must be based on a knowledge of the mosquito-borne diseases present in a given area, their relative endemicity or epidemicity largely determining the amount of time and money to be expended. In some parts of the world the degree of discomfort occasioned by pest mosquitoes or economic considerations determine the appropriation of funds for abatement projects. In Japan, any or all of these factors may be considered, depending on the time of the year, seasonal variations in the intensity of mosquito activity, geographic location, and the presence in some seasons of mosquito-borne epidemics.

About 30 percent of the land in Japan is arable and the populated areas coincide closely with areas potentially productive agriculturally. Similarly the mosquito-control areas coincide closely with the arable land since the remainder of the country is mountainous and sparsely

populated. The total land area of Japan exclusive of Hokkaido is 113,000 square miles. The 30 percent which is populated represents an area of about 34,000 square miles that would require coverage at 10-day intervals over a period of at least 4 months each year, if abatement were to be successful. It is, therefore, doubtful whether abatement on a nation-wide basis, exclusive of the northernmost island of Hokkaido, is feasible. Public health is purchasable, for a price, but the cost of this phase would probably be too great to be justified by the resulting improvement in health. The long-term plans for expenditures of public funds for mosquito-abatement programs in Japan must be economically sound, and must be capable of successful accomplishment.

Some indication of the relative success we have met thus far in control operations may be deduced from field survey data obtained over several years. Human beings were used as bait and capture of adult mosquitoes were made as they settled on their victims. Biting intensity records were made at 3- to 4-day intervals between 1940 and 2300 hours from late July to the end of the first week in September in 1946 and 1947. A large city of over a million inhabitants and a typical rice-growing district were selected for study since these areas afforded an opportunity for comparison of population densities in typical urban and rural localities. During 1946, in the urban area, biting intensities varied from an average hourly low of 6 to a high of 35 per hour and throughout August the average biting rate never fell below 20 in all hourly periods recorded. During the same year in the rural area biting rates varied from an average low of 20 to a high of over 100 per hour. Similar observations at the same collection points were made in the summer of 1947. While the biting rates were slightly lower in 1947, the extent of reduction was not significant.

During July and August 1948 large numbers of resting adult females were collected in the vicinity of Okayama in southern Honshu and frequently a single stable yielded several thousand mo-quitos. Stables were usually small and seldom sheltered more than a few domestic animals. Similarly, light trap collections made in the same area yielded from 500 to over 1,000 mo-quitos in a single night's catch. These figures indicate that despite the control program, a sufficient mosquito population was maintained to present a serious pest or disease vector problem if mosquito-borne diseases had made their appearance.

All of the factors underlying the 1948 outbreak of Japanese encephalitis, the largest in the history of Japan, are not known. While it is possible that the magnitude of the outbreak could reflect a breakdown in efficiency of mosquito-control operations as compared with the 2 previous years, it is doubtful on the basis of previously cited data

that an outbreak of the same magnitude might not have occurred sooner had other requisite factors occurred. We must recognize the fact that in the third year of the mosquito-control program in Japan its inadequacy in controlling Japanese encephalitis was evident. So far only the surface in effective mosquito eradication has been touched even in the large urban centers of population. In smaller communities and rural areas the situation is probably much the same as it was prior to the war. The progress made represents a beginning but the task ahead is tremendous if the ultimate goal is mosquito control, limited even to the larger population centers.



# A Method for Testing Sensitivity of Organisms to Antibiotics

JOHN P. RANSOM, Major, MSC, U. S. A.<sup>1</sup>

THE clinical effectiveness of penicillin is paralleled by the sensitivity of the invading organisms *in vitro* (1) (2). The efficacy of penicillin in the treatment of infection may be accurately determined by testing the sensitivity of the organism *in vitro* (3). Penicillin K is more active *in vitro* than *in vivo* (4). This fraction has now been largely eliminated from commercial preparations. A similar parallelism between *in vitro* and *in vivo* activity has been shown for streptomycin. These facts have been reviewed and summarized recently by Keefer (5) and Goldstein (6). Sensitivity tests on organisms are desirable if the proper antibiotic is to be prescribed in the optimal dosage. Frequently, an organism that shows a high degree of resistance to penicillin will be found to be sensitive to streptomycin. The sensitivity spectra of organisms isolated from human infections have thus become as important as their isolation and identification. Goldstein emphasizes the importance of frequently determining organism sensitivity and, as far as possible, increasing the dosage of the antibiotic to meet new thresholds.

*Penicillin sensitivity test.*—A stock dilution of penicillin potassium containing 20 units per ml. is prepared in sterile physiologic saline solution. The following dilutions are then prepared 10, 5, 2.5, 1.25, 0.62, 0.31, and 0.15 units per ml. One milliliter of each dilution is added to a sterile labeled Petri dish to which is then added 9 ml. of melted and cooled tryptose blood agar with a pH of 6.8. The contents of each Petri dish is mixed before solidification by gentle clockwise and counterclockwise rotation. Plates may be stored in the refrigerator for not more than 24 hours before use. The final concentrations represented by these plates are 1, 0.5, 0.25, 0.125, 0.06, 0.03, and 0.015 units per ml.

<sup>1</sup> Oliver General Hospital, Augusta, Ga.

Well-isolated colonies of organisms to be tested are transferred from diagnostic plates to small test tubes containing about 1 ml. of tryptose phosphate broth to which has been added a loopful of sterile, Seitz-filtered, human serum. These booster broth tubes are incubated at 37° C. Control cultures of *Staphylococcus aureus* (Heatley, Eden, or F. D. A. 209P) are set up at the same time. In this laboratory, a culture of a penicillin-resistant staphylococcus is also prepared.

A sterile cotton swab is saturated with the booster broth culture after incubation for 4 to 6 hours. Excess medium is squeezed from the cotton tip against the side of the tube. A sector of each penicillin plate and of a control plate without penicillin is inoculated with the swab, making a single line streak on each plate, working from the plate containing the lowest to the one containing the highest concentration, inoculating the control plate first. Separate sectors are thus inoculated with various organisms to be tested. Six organisms can be conveniently tested on a single set of plates. Each set should also be inoculated in sectors reserved for the control organism. The results are read after overnight incubation. Growth or lack of growth is recorded for each organism on each plate. The sensitivity is then reported as the lowest concentration at which growth is completely inhibited.

*Streptomycin sensitivity test.*—The stock solution for the streptomycin sensitivity test contains 640 micrograms per ml. The following dilutions are then prepared in physiologic saline solution: 640, 320, 160, and 80 micrograms per ml. Plates prepared in the manner previously described are used, except that the agar base is adjusted to a pH of 8. The final dilutions represented by four plates are 64, 32, 16, and 8 micrograms per ml. Preparation of the organisms to be tested, inoculation of the media, and reading of the results are similar to that described for the penicillin sensitivity test. *Proteus OX19* may be used as a control organism. The cultures of this organism employed here do not grow on the lowest concentration of streptomycin used.

#### DISCUSSION

Routine sensitivity testing of isolated organisms may be adjusted to meet local needs. Beta-hemolytic streptococci from sputa, wounds, abscesses, pleural fluids, urine, blood, and aural discharges are tested for sensitivity to penicillin, and if found to be resistant, are tested for sensitivity to streptomycin. Staphylococci are treated similarly. Gram-negative rods are tested for sensitivity to streptomycin only. Such organisms as *Neisseria gonorrhoeae* and *Diplococcus pneumoniae* are not routinely tested because they are regularly sensitive. Organisms that require special growth factors or atmospheric conditions,

such as *Hemophilus influenzae* and *Clostridium welchii*, are not routinely tested because special attention to the details of technique is necessary with such organisms. The sensitivity tests described have advantages in that (a) they are sufficiently accurate to be clinically useful, (b) they can be applied readily to most of the pathogenic bacteria isolated, and (c) the results can be read within 48 hours after the initial isolation.

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# About the Army Medical Department

## The New Army and Air Force Interns

PAUL L. ROBINSON, *Colonel, MC, U. S. A.*

FROM 1,014 applications, 199 interns were selected for Army internships and 53 for Air Force internships. Both Army and Air Force interns receive their training in Army general hospitals. Of the 252 selectees, 236 have had previous service in the Armed Forces; 44 of the 53 selected by the Air Force had prior service with the Army Air Force; and 28 of the 252 had wartime service in the Medical Service Corps. The General Staff Corps, Infantry, Field Artillery, Coast Artillery Corps, Corps of Engineers, Armored Cavalry, Quartermaster Corps, Military Intelligence Service, Adjutant General's Department, and Ordnance Department are all represented in the former service of our interns. The composite nature of the group is further indicated by the fact that 5 were Marines and 18 were in the Navy during the war.

Five of our interns had advanced to the grade of lieutenant colonel during their former service, 25 to major, and 51 to captain. They all now come in as first lieutenants in the Medical Corps and will not be eligible for promotion until they have finished their internships. While promotions after an internship depend to a large extent on the vacancies which will exist at that time, it is expected that it will be possible to promote Medical Corps officers to the grade of captain sometime during the year following the completion of their internships.

Fifty-four of our interns this year will be assigned to Walter Reed General Hospital, Washington, D. C.; 35 to Letterman General Hospital, San Francisco, Calif.; 34 to Fitzsimons General Hospital, Denver, Colo.; 30 to Madigan General Hospital, Tacoma, Wash.; 14 to William Beaumont General Hospital, El Paso, Tex.; 24 to Tripler General Hospital, Honolulu, T. H.; 11 to Gorgas Hospital, Ancon, C. Z.; and 50 to Brooke General Hospital, San Antonio, Tex. Many of the selectees had appointments in other Army hospitals that have since been closed and have had changes in their assignments. These reassessments were accomplished without difficulty and without detri-

<sup>1</sup> Personnel Division, Office of the Surgeon General, Department of the Army.

ment to the internship programs in any of the remaining hospitals. All training spaces are fully authenticated by the Council on Education and Hospitals of the American Medical Association.

In order that interns will get even broader experience, a system of rotation through suitable local Army or Air Force medical installations has been instituted at two of our hospitals. Under this system, many of this year's interns will have an opportunity to serve a few months in station hospitals as well as general hospitals. For example, interns at Walter Reed General Hospital will rotate through a total of 11 services: 4 in obstetrics and gynecology, 2 each at Fort Belvoir Station Hospital and Bolling Field Station Hospital; 3 in general surgery, 1 at Fort Belvoir Station Hospital and 2 at Bolling Field Station Hospital; and 4 in internal medicine in the hospital at the Old Soldiers' Home, Washington, D. C. Interns assigned to Letterman General Hospital may rotate through 11 services in medicine, surgery, obstetrics, and electives at Fort Ord Station Hospital and Camp Stoneman Station Hospital. Other hospitals may work out similar plans with nearby installations that have adequate staffs in the specialty in which the intern is rotated. In every case, the training will remain under the supervision of the appropriate professional service of the parent hospital and not more than 25 percent of the interns assigned will be absent from the parent hospital at any one time under the rotating plan. An intern will be rotated but once and at only one of the satellite installations. It is expected that this plan will acquaint the participating intern with an attractive phase of military life and at the same time afford him the opportunity to render medical care of a limited nature more on his own responsibility than might have been possible in a larger hospital.

Interns were appointed under the cooperative plan agreed on by the Association of American Medical Colleges, the American Medical Association, the American Hospital Association, the American Protestant Hospital Association, and the American Catholic Hospital Association. In selecting interns, special consideration was given this year to participants in the Medical Reserve Officers Training Corps Program and to those who indicated that they were definitely interested in a military career.

Within the past few months the Army, Navy, and Air Force Medical Departments have all agreed in the publication by the Secretary of Defense of standard policies applying to interns and residents. One of the policies requires that interns entering the program after 1 December 1950 will do so with the understanding that they will be required to serve 1 year of active duty for each year of formal internship in a military hospital. This does not apply to the group of interns coming on duty between 1 July 1950 and 31 December 1950.

As in previous years, internships in Army hospitals are rotating in character and are of 12 months' duration. In general, duties of interns correspond to those in civilian hospitals and there is ample opportunity for discussions of problems with both military and civilian teachers in the fields of clinical medicine. On satisfactory completion of 8 months of internship, interns become eligible to apply for appointment in the Regular Army. They will not be commissioned until after the internship has been completed. Interns may also extend their Reserve categories for 1, 2, or 3 years—an opportunity embraced by many of last year's interns in order to further their knowledge of military medicine before definitely electing it as a career.

As the year of internship progresses, many will be interested in what the future holds. Some of this group will want information regarding the basic medical course at the Army Medical Department Research and Graduate School and the Medical Field Service School. Others will be interested in residencies in one specialty or another. Information on all these subjects will be made available from time to time and representatives of the Surgeon General's Office will be available to discuss the various problems now and then during the internship year. All of the assignments to schools and residencies, in which interns are interested will be awarded by means of definite policies that will be made known to everyone. The standing the officer achieves in his internship will have no little weight in the final selection because effort is made to keep everything on a fair and just competitive basis.

Those of us who interned in the Army many years ago look back at this period with nostalgia. It is with all sincerity, therefore, that we welcome this group of interns to our military hospitals. We are sure that many of them will also, as years go by, have the same feeling of pride that we have when we mention our internship classes at Walter Reed, Fitzsimons, or any of the other hospitals that have grown to mean so much in the military establishment.

#### Meet the 1950 interns:

##### *Army interns*

Name	Medical school	Hospital of internship
Anlage, Henry J.	St. Louis University	Fitzsimons
Azrouel, Asdrubal	Temple University	Walter Reed
Cany, Loyal D.	Yale University	Brooke
Askins, John R., Jr.	University of Oklahoma	Fitzsimons
Babb, John L.	Ohio State University	Brooke
Barilis, Timothy O.	George Washington University	Walter Reed
Bennett, Arthur J.	Georgetown University	Brooke
Bursh, James F.	University of Georgia	Madigan
Beckner, William W., Jr.	Medical College of Virginia	Greens
Beddow, Ralph M.	University of Oregon	Walter Reed
Bennett, Reginald V., Jr.	Duke University	William Beaumont
Billing, Harry H.	University of Minnesota	Tripler
Blair, Robert T.	University of Cincinnati	Walter Reed
Blaschke, John A.	University of Oklahoma	Letterman

## Army interns—Continued

Name	Medical school	Hospital of internship
Bolton, Bill F.	Yale University	William Beaumont
Borch, Anthony A.	Yale University	Fitzsimons
Bosman, Robert C.	Yale University	Walter Reed
Borsen, William A.	Yale University	Do
Brand, Roger C., Jr.	Yale University	Brooke
Breakstone, Gerald J.	Yale University	Letterman
Breitbart, Otto W.	Yale University	Fitzsimons
Brock, Mason F.	Yale University	Tripler
Brooks, Donald A.	Yale University	St. Luke's
Brown, Paul W.	Yale University	Letterman
Brown, William F.	Yale University	Madigan
Brown, Stephen M.	Yale University	Do
Buchele, Matthew J.	Yale University	Brooke
Buckmeier, George	Yale University	Madigan
Bucci, John F.	Yale University	Do
Burner, Haynes C.	Yale University	Tripler
Callata, Richard J.	Yale University	Madigan
Casey, John J.	Yale University	George
Casper, Robert B.	Yale University	Fitzsimons
Chadwick, John R.	Yale University	Gates
Chesser, Roswell S.	Yale University	Walter Reed
Clark, Thornton F.	Yale University	Brooke
Coats, Daniel T.	Yale University	Letterman
Collier, Richard L.	Yale University	Brooke
Corpele, John F.	Yale University	Fitzsimons
Craig, Gus A.	Yale University	Madigan
Critchall, Vernon	Yale University	Fitzsimons
Dankle, John K.	Yale University	William Beaumont
Deak, John H.	Yale University	Brooke
Delia, Claude W.	Yale University	Do
Desimone, John S.	Alberta Medical College	William Beaumont
Deutelle, Edward P.	University of Minnesota	Tripler
Dowle, Patrick J.	Tulane University	Brooke
Earle, Leon H., Jr.	do	Walter Reed
Faver, Charles C.	Rockefeller University	William Beaumont
Feldstein, John W., Jr.	State University of Iowa	Letterman
Filward, Thomas S.	Tulane University	Brooke
Fisher, Lindsey T., Jr.	Harvard University	William Beaumont
Fils, Kent	Yale University	Walter Reed
Fogel, Harold L.	University of Southern California	Letterman
Foss, John	University of Pittsburgh	Walter Reed
Fittinger, Charles	New York University	Walter Reed
Fwart, James A.	University of Pennsylvania	Do
Feldmann, Robert J.	Harvard University	Brooke
Ferguson, Robert P.	State University of Iowa	Tripler
Fineberg, Milton	University of Pennsylvania	Fitzsimons
Finn, Murray F.	St. Louis University	Gates
Flaser, Carl	University of Colorado	Brooke
Foerton, Luther G., Jr.	Fordham University	Fitzsimons
Frankboner, C. M., Jr.	Long Island College	Brooke
Frederickson, Frank L.	University of Wisconsin	Walter Reed
Freeman, Ray W.	Northwestern University	Walter Reed
Fremont, Vernon L.	Emory University	Fitzsimons
Geeter, Hatch C., Jr.	do	Walter Reed
Glenn, James C.	University of Oklahoma	Brooke
Goates, Ralph G.	University of Utah	Walter Reed
Grant, John F.	University of Buffalo	Fitzsimons
Grant, Arthur F.	Western Reserve University	Madigan
Grant, Norman L.	Columbia University	Walter Reed
Green, Robert W.	University of Pittsburgh	William Beaumont
Greene, John P.	Duke University	Letterman
Gross, Kenneth A.	University of Illinoian	Walter Reed
Gulledge, Oskar S.	Johns Hopkins University	Do
Hall, R. G. V.	University of Arkansas	Letterman
Hall, Thomas M.	Vanderbilt University	Brooke
Harmatz, Rufus R.	Duke University	Fitzsimons
Harrison, Edward L.	do	Walter Reed
Hawes, Joe S.	Jefferson Medical College	Brooke
Hanson, Victor R.	University of Oregon	Walter Reed
Harris, John F.	do	Do
Harrison, William V.	New York University	Madigan
Hawkins, James C.	Washington University	William Beaumont
Hedges, Maurice I.	University of Tennessee	Fitzsimons
Henderson, James F.	Western Reserve University	Walter Reed
Hewitt, John W., Jr.	Medical College of Virginia	Madigan
Hoffman, Frederick J.	Washington University	Fitzsimons
Huey, Joseph H.	Medical College of Virginia	Walter Reed
Hughes, Alan R.	University of Minnesota	Madigan
Johnson, Francis F., Jr.	George Washington University	Fitzsimons
Johnson, E. Faust M.	St. Louis University	Letterman
Kearns, William O.	Emory University	Walter Reed
Kellchberger, Robert F.	St. Louis University	Tripler
Kitchen, Lloyd	Emory University	Brooks
		Do
		Tripler

*Army interns—Continued*

Name	Medical school	Hospital of internship
Kokernot, Robert H.	Baylor University	Brooke
Kruze, Francis Jr.	University of Colorado	Letterman
LaTourrette, Verne G., Jr.	New York Medical College	Fitzsimons
Langsjoen, Per H.	University of Minnesota	Letterman
Lawrence, John C.	Vanderbilt University	Gorgas
Levi, George A.	Medical College of South Carolina	Tripler
Lewis, Charles P., Jr.	Duke University	Brooke
Lindner, Janis C.	Yale University	Walter Reed
Littiman, Maxwell L.	Tulane University	Do
MacLean, Donald B.	Wayne University	Letterman
Maeomber, Peter B.	Harvard University	Madigan
Meeks, Edwin A.	Vanderbilt University	Walter Reed
Metzger, Joseph F.	George Washington University	Do
Miller, Gordon D.	University of Southern California	Letterman
Mizell, Walter S.	University of Arkansas	Madigan
Moore, Carlyle C.	State University of Iowa	Letterman
Morgan, Francis W.	University of Nebraska	Madigan
Morris, John De L. S.	Cornell University	Letterman
Mott, Richard H., Jr.	George Washington University	Madigan
Mounts, Billy W.	Georgetown University	Letterman
Mueller, Harold W.	University of Nebraska	Madigan
Munn, Richard E.	Bowman Gray University	Letterman
Muth, Jack R.	Western Reserve University	Madigan
McCanless, Dean	University of Georgia	Gorgas
McClintahan, Frank C.	University of Tennessee	Tripler
McClatchey, Sam P.	University of Nebraska	Do
McCloskey, Walters, Jr.	New York Medical College	Madigan
McConnell, Bright	University of California	Letterman
McFroy, George R., Jr.	Tufts College	Tripler
McGee, Robert R.	Wayne University	Letterman
McGrade, Hugh P.	Western Reserve University	Brooke
McLeod, Donald G., Jr.	do	Do
Neill, Fred J.	University of Georgia	Walter Reed
Naz, John F.	New York Medical College	Madigan
Nelson, Robert C.	Warren University	Letterman
Neyer, John H.	College of Medical Evangelists	Madigan
Nichols, William H., Jr.	Loyola University	Madigan
Nicotri, Benjamin	Washington University	Fitzsimons
Nora, James C.	George Washington University	Letterman
Norrell, Milton G., Jr.	do	Madigan
O'Sullivan, Donald D.	Baylor University	Letterman
Obourne, Robert L.	Yale University	Madigan
Parrish, Matthew D.	University of Virginia	Letterman
Peat, Bertram L.	Washington University	Madigan
Pope, James K.	do	Letterman
Preston, Charles L.	Bowman Gray University	Madigan
Quinn, Robert E.	University of Cincinnati	Letterman
Rankin, Richard E.	Yale University	Madigan
Reed, Jack D.	University of Virginia	Letterman
Reeve, Arnold M.	Baylor University	Madigan
Richter, Philip D.	Warren University	Letterman
Richards, Charles F.	Washington University	Madigan
Richardson, William L.	University of Utah	Letterman
Rhipps, William D.	Duke University	Madigan
Ridlin, the Joseph S.	do	Letterman
Rose, John C.	University of Arkansas	Madigan
Sand, Richard F.	Georgetown University	Letterman
Sanderson, George M., Jr.	Ohio State University	Madigan
Scott, Leigh H., Jr.	University of Buffalo	Madigan
Sellers, Thomas D.	Emory University	Letterman
Shannon, Kart, Jr.	Duke University	Madigan
Shapiro, Norman D.	University of Arkansas	Letterman
Sheehy, James L.	University of Tennessee	Madigan
Slusher, Paul W.	Stanford University	William Beaumont
Stiles, William B., Jr.	University of Illinois	Letterman
Silverman, Leo H.	Brigham University	Brooke
Simmons, John H.	University of Texas	Do
Simmons, William G.	Boston University	Brooke
Slutzky, Gilbert	Ohio State University	Do
Smith, Martin E.	Wayne University	Brooke
Smith, Noel G.	Yale University	Brooke
Smith, Vastal B.	Albany Medical College	Do
Smith, W. I.	University of Arkansas	Brooke
Spyro, Franklin C.	University of Georgia	Brooke
Stilker, Daniel F.	Syracuse University	Brooke
Stark, John W.	Emory University	Do
Stephens, William A.	University of Washington	Letterman
Stewart, Robert M.	Tulane University	Tripler
Schlebenauer, Charles	Duke University	Fitzsimons
Stoddard, Darrel C.	University of Cincinnati	Do
Stone, Richardson L.	Jefferson Medical College	Letterman
Zukak, Michael	University of Georgia	Walter Reed
	Tulane University	Brooke

*Army interns—Continued*

Name	Medical school	Hospital of internship
Sweeter, Walter E.	George Washington University	Walter Reed.
Syner, James C.	Boston University	Do.
Talier, Thomas P.	Fordham University	Fitzsimons.
Teller, George W.	University of Colorado	Madigan.
Tomson Nathaniel C.	Vanderbilt University	Brooke.
Torrance Jonathan B.	University of Washington	Madigan.
Upson, Albert L.	University of Maryland	Letterman.
Van Osdell, Lewis A.	University of Colorado	Fitzsimons
Vineyard William R.	Washington University	Letterman
Vultee Frederick E.	Yale University	Walter Reed.
Wagnleit, Lloyd R.	University of Nebraska	Madigan.
Watson, William R., Jr.	University of Pennsylvania	Letterman
Wells, John H.	Lehigh Medical College	Madigan
Wenckebach Jay N.	Medical College of Virginia	Walter Reed
Wetzel, Howard R.	University of Indiana	Madigan
Whayne Harry U.	Tulane University	Walter Reed
Wright, Lloyd T.	University of Illinois	Brooke
Youngs, Harry H., Jr.	Duke University	Do.
Zahn, Gregory J.	New York Medical College	Walter Reed
Zelichowsky Henry T.	Long Island Medical College	Tripler

*Air Force Interns*

Adams, Robert H.	University of Kansas	Madigan
Angel, Ronald W.	University of Washington	Walter Reed
Atkins, George N.	University of Oklahoma	Do.
Blankston Ingram W.	Alabama Medical College	Letterman
Brealey Homer L.	St. Louis University	Brooke
Brenkman Ward F.	University of Kansas	Tripler
Bennett James F.	University of Michigan	Fitzsimons,
Brown Harry F.	University of Southern California	Tripler
Craig Fletcher F.	University of Nebraska	Letterman
Crabtree Sam F.	Alabama Medical College	Tripler
Cronin Paul F.	University of Nebraska	Letterman
Crowe Louis M.	Jefferson Medical College	Michigan
Demlow Jack H.	University of Indiana	Walter Reed
Dewey Walter W.	Baylor University	Letterman.
Doss Charles W.	University of Colorado	Do.
Donald Alonzo M., Jr.	do	Michigan
Dornhoff George	Alabama Medical College	Brooke
Eakle Clarence G.	Southwestern Medical College	Do.
Frayser Louis A., III	Duke University	Fitzsimons.
George John W.	University of Indiana	Letterman.
Gillotti Benjamin W.	Baylor University	Brooke
Gray Bob	University of Oklahoma	Do.
Grosvenor D. Jr.	University of Louisville	Michigan
Hall Oscar	University of Texas	Brooke
Hardy Donald M.	do	Brooke
Hansen James P.	University of Georgia	Brooke
Hendrick John T.	Louisiana State University	Do.
James Julian T., Jr.	do	Fitzsimons
Johnson Chester W., Jr.	University of Minnesota	Genes
Jones Frederick H.	Tulane University	Do.
Kilmack Robert M.	University of Georgia	Brooke
Levine Robert	Ohio State University	Walter Reed
Mann Edwina F.	Tulane University	Do.
Marsh James W.	University of Arkansas	Michigan
Moore James C.	University of Texas	Brooke
Morgan Christopher D., Jr.	Alabama Medical College	Tripler
Myers William M., Jr.	University of Utah	Michigan
Mekhora Wendell F.	Baylor University	Tripler
Nichols Thomas A., Jr.	University of Colorado	Fitzsimons
Norton Austin T.	St. Louis University	Brooke
Puckett Eddie F.	University of Louisville	Walter Reed
Reynolds George F.	University of Michigan	Letterman
Rick Herbert G.	Harvard University	William Beaumont
Schwartzmeier Blaud H.	Baylor University	Tripler
Shuler James A.	Jefferson Medical College	Walter Reed
Simmons Frederick R.	University of Maryland	Do.
Smith Arthur G.	Syracuse University	Do.
Sorenson Ned E.	University of Southern California	Tripler
Staples Leitham F., Jr.	University of Georgia	William Beaumont
Tanner David F.	do	Fitzsimons
Taylor George F., Jr.	University of Buffalo	Walter Reed
Touche Armand J.	Louisiana State University	Fitzsimons
Watson William F.	Temple University	Do.

# The Station Hospital as a Diagnostic and Treatment Center

WALTER F. BOWERS, *Colonel, MC, U. S. A.<sup>1</sup>*

**A**N INEVITABLE train of events that will greatly increase the importance of the smaller Army hospitals, make assignment there highly desirable, and increase the prestige of medical care at the post level will take place shortly. This end result is one toward which we have been striving and is the goal toward which all of our specialist training has been directed. Soon we can anticipate a well-qualified, highly trained staff in almost all of the clinical specialties at each Army hospital. Before World War II, assignment at such posts as Fort Benning, Fort Riley, Fort Leavenworth, Fort Sill, and many others was considered highly desirable with all of the advantages of quarters and post life. During the war, however, we got into the habit of speaking in terms of thousands of beds and with the wartime evacuation policy, based on shortages of skilled doctors in specialized fields, station hospitals became glorified dispensaries. The connotation thus became fixed that station hospital assignments were for untrained men who could only transfer patients to a general hospital. Unfortunately this was necessary in the early days of the residency training program, but we are about to see a change for the better with the emergence of a fairly large group of trained men available for assignment. No longer will it be necessary to look condescendingly on such an assignment or to threaten resignation at the prospect. In fact, it is predicted that within the next year the emphasis will shift to the point where general hospital assignments will be less sought after than assignment to station hospitals.

Several factors bear on this point. Since there are to be fewer general hospitals, there will be fewer career possibilities in the general hospital system and more trained men will be needed in the station hospitals. As more trained men are assigned to smaller hospitals, a changed evacuation policy will allow any type of treatment to be given

<sup>1</sup> Office of the Surgeon General Department of the Army.

values in blood chemistry, normal blood values, cerebrospinal fluid; and the laboratory tests used in the study of jaundice and liver diseases.

This is an excellent book not only for the internist, surgeon, and general practitioner, but also for the laboratory worker—Capt. J. L. Schurz (MC) U. S. A.

**MITCHELL NELSON TEXTBOOK OF PEDIATRICS**, edited by Waldo E. Nelson, M. D., Professor of Pediatrics, Temple University School of Medicine, Medical Director of Saint Christopher's Hospital for Children, with the collaboration of 63 contributors. 5th edition. 1,654 pages. 426 illustrations. W. B. Saunders Co., Philadelphia, Pa., publishers, 1959. Price \$12.

This new edition of a standard text on pediatrics tackles the admittedly difficult problem of encompassing the various aspects of child care in a single volume with admirable thoroughness. Those who are familiar with the fourth edition will find ample evidence of rewriting throughout, with several new names in the list of contributors. The volume contains 306 more pages than the previous edition with new or completely rewritten sections on growth and development; parenteral fluid therapy, drug therapy; anesthesia; congenital malformations; inborn errors of metabolism; the newborn; infection, immunity and allergy; viral diagnosis, streptococcal infections, histoplasmosis; tumors of the neck, congenital heart disease, the blood; mental deficiency; the endocrine system; bones and joints, muscles, burns, and adolescence. The editor is one of the chief contributors and he has done a monumental job of incorporating the advances of the 5 years between editions in the new volume. The two-column page has been retained for the sake of compactness and ease of reading. Extensive references are given at the end of each section. Several useful appendices appear in the back. An elaborate index which is almost twice the size of that found in the fourth edition is provided—Col. W. G. Brandstadt, MC, U. S. A.

**BALANCE FOOD AND DIETARY ANALYSES**, by Marjorie R. Mattie, A. B., Sc. M., Assistant Professor of Biochemistry Graduate School of Medicine, College of Medical Engineers, Los Angeles, Calif., formerly Assistant Professor of Pathological Chemistry, Department of Medicine, New York Post Graduate Medical School, Columbia University, Chief Chemist, New York Post Graduate Hospital, Consultant Chemist, Department of Correction Hospitals, City of New York, 3d edition, thoroughly revised. 412 pages. Lippincott, Philadelphia, Pa., publisher, 1956. Price \$7.50.

This third edition of a classical reference is a complete revision of the second which was published in 1947. It more than achieves its objective of providing analytical data on the largest possible number of food factors.

Newer knowledge in the field of human nutrition and the latest in analytical data have been incorporated. Some old material was deleted and considerable rearrangement of the remaining material was undertaken so as to emphasize the changing points of view. This has necessitated a completely different approach from that of classical biochemistry. The inter-relationships and inter-dependency of the more than 40 specific individual factors now recognized as a part of the picture of normal nutrition are carefully delineated throughout the book. Emphasis is laid on variables which affect the nutritive content of foods and the precise requirements of the individual.

The chapter on vitamins has undergone considerable revision and enlargement and covers the subject as thoroughly as the comprehensive nature of this volume permits. Considerable attention has been given to the effect of various kinds of processing upon nutritive values.

There is data on the sodium and potassium content of approximately 500 representative foods and 170 municipal water supplies. Additional tables which have been incorporated include gastronomic foods strained and chopped or junior foods, and Dr. Helen B. Pryor's width-weight tables used in establishing a proper column of expected weight (up to 24 years of age).

There is a 20-page bibliography arranged topically, which should prove very valuable to those in search of more detailed studies of the subjects thus documented.

This book is highly recommended for use as a reference by clinicians, dietitians, nurses, public health and welfare workers, medical students and consultants in diet preparation.—*Maj. M. E. Perig, U. S. A. F. (WMSC).*

**RACES.** A Study of the Problems of Race Formation in Man, by Carleton S. Coon, Ph. D., Curator of Ethnology, University of Pennsylvania Museum, Philadelphia, Pa.; Stanley M. Garn, Ph. D., Research Fellow in Anthropology, Forsyth Dental Infirmary for Children, Boston, Mass., and Joseph B. Birdsell, Ph. D., Assistant Professor of Anthropology, University of California, Los Angeles, Calif. Publication No. 77 American Lecture Series. 153 pages; Illustrated. Charles C. Thomas, Springfield, Ill., publisher, 1950. Price \$3.

This is a very interesting and thought-provoking dissertation in physical anthropology. The authors bring into play many facts and theories relating to the development of the races of man. They highlight the role of natural selection in the production of genotypes and phenotypes and point out the many reasons for their belief that races are developed because of the natural selection which follows mutations. Ninety percent of the 40,000 genes in the human chromosomes control the capacity of the organism for action and reaction to environment, and determine phenotypes, genotypes, and physiologic resistance to disease. Mutations occur because of outbreeding and because of geographic and climatic environment, and technico-cultural advances in a race. In the last chapter they attempt to classify races by types and stock, and present what appears to be a very adequate grouping and classification as well as a physical description of many races.

The physician and dentist, particularly, will find this a very interesting presentation.—*Capt. J. L. Schwartz (MC) U. S. N.*

#### BOOKS RECEIVED

Receipt of the following books is acknowledged. As far as practicable, they will be reviewed at a later date.

**PRINCIPLES AND PRACTICE OF PLASTIC SURGERY,** by Arthur Joseph Birsky, M. D., D. D. S., Attending Plastic Surgeon, Beth Israel Hospital, New York City; Attending Plastic Surgeon, Morrisania City Hospital, New York City; Attending Plastic Surgeon, Bronx Hospital, New York; Attending Plastic Surgeon, Beth El Hospital, Brooklyn, N. Y.; Attending Plastic Surgeon, New York State Rehabilitation Hospital, West Henrietta, N. Y.; Clinical Professor of Surgery and Associate Surgeon, New York Polyclinic Medical School and Hospital; American Board of Plastic Surgery; American Society of Plastic and Reconstructive Surgeons; American Association of Military Surgeons; Associate Member of British Association of Plastic Surgeons; Associate Member of Mexican Association of Plastic Surgeons; formerly Lieutenant Colonel, MC, A. U. S. 499 pages; Illustrated. The Williams & Wilkins Co., Baltimore, Md., publishers, 1950. Price \$10.

**ESSENTIAL UROLOGY,** by Fletcher H. Colby, M. D., Chief of the Urological Service, Massachusetts General Hospital; Assistant Clinical Professor of Genito-Urinary Surgery, Harvard Medical School, Boston, Mass.; Urological Consultant, Lakeside State Sanatorium, Middleboro, Mass. 580 pages, Illustrated. The Williams & Wilkins Co., Baltimore, Md., publishers, 1950. Price \$8.

**1949 YEARBOOK OF OBSTETRICS AND GYNECOLOGY (October 1948–August 1949),** edited by J. P. Greenhill, B. S., M. D., F. A. C. S., Professor of Gynecology Cook County Graduate School of Medicine; Attending Gynecologist, Cook County Hospital; Attending Obstetrician and Gynecologist, Michael Reese Hospital, Associate Staff, Chicago Lying-In Hospital. Author of *Office Gynecology and Obstetrics in General Practice*, Co-author of the DeLee-Greenhill *Principles and Practice of Obstetrics*. 629 pages; Illustrated. The Year Book Publishers, Inc., Chicago, Ill., publishers, 1950. Price \$1.50.



**HANDBOOK OF OBSTETRICS AND DIAGNOSTIC GYNECOLOGY**, by Leo Doyle, M. S., M. D. Illustrations by Ralph Sweet. 240 pages; Illustrated. University Medical Publishers, Palo Alto, Calif., publishers, 1950. Price \$2.

**A SHORT HISTORY OF PHYSIOLOGY**, by Kenneth J. Franklin, D. M., F. R. C. P., Professor of Physiology at the Medical College of St. Bartholomew's Hospital. 2d edition. 147 pages; Illustrated. Staples Press, New York, N. Y., publishers, 1950. Price \$2.

**OCCUPATIONAL THERAPY, Principles and Practice**, edited by William Bush Dunton, Jr., M. D., *Prauder and Farmer Editor, Occupational Therapy and Rehabilitation*, and Sidney Licht, M. D., *Editor, Occupational Therapy and Rehabilitation*. 321 pages, Illustrated. Charles C Thomas, Springfield, Ill., publisher, 1950. Price \$6.

**TREATMENT IN PSYCHIATRY**, by Oskar Diethelm, M. D., *Professor of Psychiatry, Cornell University Medical College, Psychiatrist-in-Chief, The New York Hospital ( Payne Whitney Psychiatric Clinic)*. 2d edition. 574 pages. Charles C Thomas, Springfield, Ill., publisher, 1950. Price \$8.50.

**UROLOGICAL SURGERY**, by Austin Ingram Dodson, M.C., F. A. C. S., Richmond, Va., *Professor of Urology, Medical College of Virginia, Urologist to the Hospital Bells, Medical College of Virginia, Urologist to Crippled Children's Hospital, Urologist to St. Elizabeth's Hospital; Urologist to St. Luke's Hospital and McGuire Clinic, with 12 contributors*. 2d edition. 835 pages, 645 illustrations. The C. V. Mosby Co., St. Louis, Mo., publishers, 1950. Price \$13.50.

**TEXTBOOK OF BACTERIOLOGY**, by Joseph M. Dongherty, A. B., M. A., Ph. D., *Dean of the School of Science and Professor of Bacteriology, Villanova College, Fellow of the American Association for the Advancement of Science, and Anthony J. Lamberti, II, B. S., Instructor in Bacteriology and Parasitology, Temple University School of Medicine; formerly Instructor in Bacteriology, Villanova College, Member of the American Public Health Association*. 2d edition. 491 pages; Illustrated. C. V. Mosby Co., St. Louis, Mo., publisher, 1950. Price \$3.75.

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POSTGRADUATE GASTROENTEROLOGY, as Presented in a Course Given Under the Sponsorship of the American College of Physicians in Philadelphia, December MCMXLVIII. Edited by Henry L. Bockus, M.D., Professor of Gastroenterology, University of Pennsylvania Graduate School of Medicine. 670 pages; 258 figures. W.B. Saunders Co., Philadelphia, Pa., publishers, 1950 Price \$10

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CIVILIAN NUTRITION, edited by Norman Jolliffe, M.D., F.P.T.S., M.D., and Paul R. Cannon, M.D., for the Food and Nutrition Board of the National Research Council. 925 pages, illustrated. Paul B. Hoeber, Inc., New York, N.Y., publisher, 1950 Price \$12

BIBLIOGRAPHY OF OCCUPATIONAL MEDICINE Vol. 1 1948 Published by International Labor Office Geneva Switzerland Price \$1

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**HORMONES IN CLINICAL PRACTICE**, by H. E. Neuburg, M. D., Research Associate, Department of Endocrinology, and Assistant Professor, Department of Oncology, University of Georgia; Lecturer Research Endocrinologist, Department of Obstetrics and Gynaecology, British Post-Graduate Medical School, and Clinical Assistant, Endocrine Clinic, Westminster Hospital, London. 386 pages, illustrated. Paul B. Hoeber, Inc., New York, N. Y., publisher, 1950. Price \$5.50

**THE 1949 YEAR BOOK OF NEUROLOGY, PSYCHIATRY AND NEUROSURGERY** (December 1948–October 1949) NEUROLOGY edited by Roland P. Mackay, M. C., Professor of Neurology, University of Illinois; Attending Neuropsychiatrist, St. Luke's Hospital, Chicago. PSYCHIATRY edited by Nolan D. C. Lewis, M. D., Director, New York State Psychiatric Institute and Hospital, Professor of Psychiatry, Columbia University. NEUROSURGERY edited by Percival Bailey, M. D., Distinguished Professor of Neurology and Neurosurgical Surgery, University of Illinois. 668 pages, illustrated. The Year Book Publishers, Inc., Chicago, Ill., publishers, 1950. Price \$5

**PSYCHIATRISM**, by N. K. Rickles, B. S., M. D., Fellow of the American Psychiatric Association, Diplomate of the American Board of Psychiatry and Neurology, Senior Consultant at the Veterans' Administration Center, Los Angeles, Consultant in Psychiatry to the Office of the Surgeon General, Medical Department, United States Army; and Director of the Psychiatric Center of Seattle. 198 pages. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1950. Price \$5

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**HABILE CRAFTING, Surgeon, Author, Artist**, by Elizabeth H. Thomson. Foreword by John P. Fulton. 317 pages, illustrated. Henry Schuman, Inc., New York, N. Y., publisher, 1950. Price \$4

**COLONIZATION, THERAPEUTICS, AND DIETETICS**, with an Appendix on Related Laboratory Procedures, by Shepard Shapiro, M. D., Assistant Professor of Clinical Medicine, New York University College of Medicine; Visiting Physician, Third (New York University) Medical Division, Goldwater Memorial Hospital, Israimite Physician, Lincoln Hospital and Murray Weiner, B. S., M. S., M. D., Fellow in Medicine, New York University College of Medicine, Research Assistant, Third (New York University) Medical Division, Goldwater Memorial Hospital, Assistant Visiting Physician, Willard Parker Hospital Chest Service, Clinical Assistant Visiting Physician, Bellevue Hospital. 131 pages. Brooklyn Medical Press, New York, N. Y., publishers, 1950. Price \$5.50

**1950 YEAR BOOK OF DERMATOLOGY AND SYPHILITICOSIS**, edited by Marion B. Sulzberger, M. D., Professor and Chairman, Department of Dermatology and Syphilis, Post Graduate Medical School; Director of Dermatology and Syphilis, Skin and Cancer Unit and University Hospital, New York University-Bellevue Medical Center, and Rudolf L. Vaer, M. D., Assistant Professor of Clinical Dermatology and Syphilis, Post Graduate Medical School, Attending Skin and Cancer Unit, New York University-Bellevue Medical Center. 514 pages, illustrated. The Year Book Publishers, Inc., Chicago, Ill., publishers, 1950. Price \$5.

PRACTICAL NEUROLOGICAL DIAGNOSIS With Special Reference to the Problems of Neurosurgery, by R. Glen Spurling, M. D., Clinical Professor of Surgery (Neurosurgery), University of Louisville School of Medicine, Louisville, Ky. 4th edition 268 pages, Illustrated Charles C Thomas Springfield, Ill., publisher, 1950. Price \$5.

A MANUAL OF BINDING, STITCHING AND SEWING, by Augustus Thorndike, M. D., F. A. C. S., Associate in Surgery, Harvard Medical School, Chief Surgeon to the Department of Hygiene, Harvard University. 2d edition 148 pages, Illustrated Lea & Febiger Philadelphia, Pa., 1930. Price \$2.

KINERSONIAN, The Mechanical and Anatomic Fundamentals of Human Motion Illustrated, by Katherine F. Wells Ph. D. Assistant Professor, Graduate Department of Hygiene and Physical Education, Wellesley College. 478 pages, 224 figures. W. B. Saunders Co., Philadelphia, Pa., publishers 1930. Price \$1.75.

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*Lectures on Lecture, 1930, President Medical Society of London, 1933.* Edited and revised by Kenneth Walker, M. A. M. B., B. C. (Cantab.), F. R. C. S. Eng., T. 1 C. S. Jacksonian Professor and Hunterian Professor Royal College of Surgeons F.R.C.S., F.R.C.P. Emeritus Surgeon to the Genito-Urinary Department, Royal Northern Hospital, Unite of Hornsey Central and Dacorum County Hospitals. Member of La Societe Internationale d'Urologie Fellow of International College of Surgeons. 3d edition 310 pages with 25 color and 31 black and white plates and 292 illustrations in the text. Paul B Hoeber, Inc., New York, N. Y., publisher, 1930. Price \$15.

THE CYTOLOGIC DIAGNOSIS OF CANCER, by the Staff of the Vincent Memorial Laboratory of the Vincent Memorial Hospital a Gynecologic Service affiliated with the Massachusetts General Hospital, Boston, Mass., the Department of Gynecology, Harvard Medical School. Published under the sponsorship of The American Cancer Society. 220 pages. Illustrated. W. B. Saunders Co., Philadelphia, Pa., publishers 1930. Price \$6.50.

MEDICINE OF THE YEAR, edited by John B. Jonmann, M. D. Dean School of Medicine, Vanderbilt University. Second issue 1930. 204 pages. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1930. Price \$3.

URINARY ROENTGENOLOGY, by Miller B. Watson, M. D., Past President American Urological Association. 3d edition 262 pages. Illustrated. Lea & Febiger Philadelphia, Pa., publishers 1930. Price \$7.50.

ELECTROCARIOGRAPHY, Fundamentals and Clinical Application, by Louis Wolff, M. D. Consulting Physician Consultant in Cardiology and Chief of the Electrocardiographic Laboratory Beth Israel Hospital, Associate in Medicine Harvard Medical School. 1st part. Illustrated. W. B. Saunders Co., Philadelphia, Pa., publishers, 1930. Price \$4.50.





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The UNITED STATES ARMED FORCES MEDICAL JOURNAL represents the unification of the BULLETIN OF THE UNITED STATES ARMY MEDICAL DEPARTMENT, published since 1922, and the UNITED STATES NAVAL MEDICAL BULLETIN, published since 1907. This joint periodical is the medium for disseminating information of administrative and professional interest to all medical personnel of the Department of Defense.

It is the aim to include in each issue administrative directives, original scientific and professional articles, editorial comments on current professional literature of special interest, clinical notes, descriptions of new devices and instruments, abstracts of articles from various medical periodicals, and notices and reviews of newly published professional books, of interest to all commissioned medical personnel of the Department of Defense.

The Director, Medical Services, and the Surgeons General of the several services extend an invitation to all medical officers, dental officers, Medical Service Corps officers, Nurse Corps officers, officers of the Veterinary Corps, all officers of the ancillary services of the medical services of the Armed Forces, and to the medical consultants of the Army, Navy, and Air Force to submit manuscripts for publication in this JOURNAL.

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Surgeon General, U. S. Army.*

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UNITED STATES  
GOVERNMENT PRINTING OFFICE  
WASHINGTON : 1950

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For sale by the Superintendent of Documents, U. S. Government Printing Office  
Washington 25, D. C.

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Subscriptions should be sent to the Superintendent of Documents, United States Government Printing Office, Washington 25, D. C.

Yearly subscription, \$4; foreign subscription, \$5.35.

Single number, 85 cents.

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OFFICE OF THE SECRETARY OF DEFENSE  
WASHINGTON 25, D. C.

THE ARMED FORCES INSTITUTE OF PATHOLOGY

One of the outstanding contributions to military medical science and to the nation's medical progress has been the Army Institute of Pathology. It has developed with the growth of medicine in this country and has rendered an essential service to the military forces, other Government agencies, and medical practice generally.

Its work long ago outgrew the physical facilities provided for it. Efforts have been made over a period of many years to provide adequate new housing.

On 21 February 1949, following study and recommendations by the Armed Forces Medical Advisory Committee, the Secretary of Defense redesignated this institution the Armed Forces Institute of Pathology and directed that plans be submitted for a new and complete building to accommodate it.

Early in 1950, the Congress passed and the President approved Public Law 495, 81st Congress, authorizing the construction of an Armed Forces Institute of Pathology and the expenditure of \$350,000.00 for the preparation of final plans, with the Institute to be located at the Army Medical Center, Washington, D. C. The final realization of this project will be a tribute to the high professional standards of the Armed Forces and to the military and civilian medical men whose foresight and long labor made it possible.

*Richard L. Mealing*

Richard L. Mealing, M. D.  
Director of Medical Services



# UNITED STATES ARMED FORCES MEDICAL JOURNAL

*Published monthly by the Department of Defense*

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THE PRINTING OF THIS PUBLICATION HAS BEEN APPROVED BY THE DIRECTOR OF THE BUREAU OF THE BUDGET, OCTOBER 19, 1949

## Field Training of Army Medical Officers

RAYMOND W. BLISS, Major General, U. S. A.<sup>1</sup>

EXAMINATION of our history and that of other great nations will reveal that major wars have occurred about every 20 to 25 years. These wars last from 2 to 4 years. If this state of affairs continues most doctors will probably experience two wars in their professional lifetime. Thus one-fifth to one-sixth of a doctor's professional life will be in a wartime practice.

An essential mission of the Medical Department is the preparation for the support of the combatant arms under wartime conditions. In the transition period following World War II the training desirable for this preparation has not been stressed. We have relied on the fact that most of our Regular Army officers had received ample training during the last war period. The changing concept of future warfare, organizational changes, and the constant development of new weapons of offense and defense make it advisable to bring these more experienced officers up to date. In the Regular Army Medical Corps we have an ever-increasing number of physicians who do not have war experience.

<sup>1</sup> Surgeon General, U. S. Army.

The unique features of medical practice required for the maintenance of health, prevention of disease and injury, and the care and rehabilitation of casualties under wartime conditions should be an important part of every medical officer's training. Orientation courses and other training in these subjects should be given early in a medical officer's career. This training is in addition to the usual residency and practical studies leading to proficiency in curative methods and toward certification by an American specialty board although it is believed that when it is properly developed the two will be closely intermingled. This type of training should increase a doctor's competence and appreciation of the professional requirements needed in a medical service during war.

There should be an early close correlation of professional medicine and the elements of administrative, staff, and command duties. By intelligent exposure doctors will undoubtedly emerge with special interest and talent in administrative, staff, and command work. They should be encouraged. These officers should be allowed to specialize, receiving opportunity for recognition and advancement equal to those of officers in any other chosen career field. With this concept in mind we should expect our specialized medical field personnel to be better trained and more actively interested in the aspects of military medicine. Conversely, our specialists in curative and preventive medicine would know the specific phases required in war and be reasonably well versed in medical field duties dealing with administration, staff, and command.

Using the previously described methods, we hope to develop capable medical officers for field duty with a constructive interest in their field of endeavor. This should give adequate medical support to field commanders and provide trained personnel for medical services in the field.

In order to aid us in meeting this need, authorization has been secured to start the Medical Department Company Officers' Course this fall. Phase I of this course will be given at the Medical Field Service School, Brooke Army Medical Center, Fort Sam Houston, Tex., and Phase II at the Army Medical Department Research and Graduate School, Washington, D. C. Phase I will open 5 September 1950 and close 2 February 1951. Phase II will open 12 February 1951 and close 29 June 1951. In addition to medical officers, dental, veterinary, and Medical Service Corps officers will attend Phase I. Only medical officers will attend Phase II.

It is planned that each officer entering the Medical Corps will have the opportunity of taking this course. Phase I will provide basic branch training to officers so that they will be thoroughly grounded

in the duties and responsibilities appropriate to company grade Medical Department officers. Phase II will provide instruction in the unique aspects of military medical practice required to supplement basic medical knowledge in the prevention, treatment, and rehabilitation of casualties as they occur in war.

This course should come as early in an officer's career as possible, preferably immediately after he has been commissioned in the Regular Army. The course should be followed by a period in which he can apply his instruction. During this period, which will usually not exceed 2 years, his duties may include assignment to a tactical medical unit. While undergoing this training in Army field medicine, he will learn the matériel and personnel means with which he will have to work in fulfilling his mission as an army field surgeon in the medical command and staff career. He will become acquainted with the rudiments of the tactics of the unit with which he serves. Most important, he will be learning to practice his profession under field conditions.

Later, between his fifth and twelfth years of service, each officer will have the opportunity to attend the advanced course at the Medical Field Service School, Brooke Army Medical Center. This course is designed to provide instruction in the light of war lessons and modern developments to insure effective development of all Medical Department units within the framework of the Department of the Army. Efficient medical support of military forces includes orientation in the organization and employment of divisions, corps, field armies and the related medical, dental, and veterinary services. Instruction is presented primarily from a staff and command viewpoint. This may be followed by a tour of duty as a division or corps surgeon, or duty in the office of an army or theater surgeon, or in the medical section of the Office, Chief of Army Field Forces.

The atomic era is here with its possibilities for producing enormous numbers of military and civilian casualties. This demands that every Regular Army Medical Department officer be fully trained in the peace years in the procedures applicable to the medical control and supervision of large scale disasters.

It is anticipated that enough officers to fulfill all requirements will become interested to the point of electing Army Field Medicine as a career. In peacetime only a few specialists in this field are required. They will consist of carefully selected officers who wish to follow this course and who show special aptitude for it. The career contemplated for medical command and staff officers will consist of attendance at certain service schools whose courses are of particular interest to the Medical Department. Specifically these are: (a) The Medical Field Service School; (b) The Infantry School at Fort Benning, Ga., The Artillery School at Fort Sill, Okla., or the Armored School at

Fort Knox, Ky.; (c) a post-graduate course in preventive medicine at the Army Medical Department Research and Graduate School; (d) The Command and General Staff College at Fort Leavenworth, Kans., (e) The Armed Forces Staff College at Norfolk, Va.; (f) The Army War College, The Industrial College of the Armed Forces; and (g) The National War College.

These school periods will be alternated with applicatory tours of duty with field medical units and refresher professional assignments in Army hospitals. This last item is considered of particular importance, for it is essential that medical command and staff officers keep fully abreast of every element of medical progress. Final goals for these officers will be such assignments as army or theater surgeons, instructors at one of the special or general service schools, duty in the medical section of the Office, Chief of Army Field Forces, or in one of the divisions of the Surgeon General's Office, or similar staff positions.

This is a brief outline of the instruction and training that is planned in order to prepare medical officers for their duties in Army Field Medicine. It also outlines in general the career that will be offered to those few carefully selected officers who show special aptitude and a desire to specialize in Army Field Medicine.



# Fundamentals in the Use and Preservation of Homogenous Bone

GEORGE W. HYATT, Lieutenant (MC) U. S. N.<sup>1</sup>

THE present-day use of preserved grafts of homogenous bone was fostered by Bush and Garber (3) in 1945. The large number of bone banks in existence today attests to their clinical value. There is little doubt that the principles of bone preservation and the surgical application of preserved bone is a permanent although, as yet, undetermined advance in orthopedics.

The physician in charge of a bone bank who does not appreciate the fundamentals of supervision will find that not only will such a bone bank fail to be of value, but also that the clinical failures that will occur may greatly delay acceptance of a fundamentally satisfactory procedure in orthopedic surgery.

One major disadvantage of the present-day methods is the lack of unequivocal control of the asepsis of the deposit. The culture of a single specimen is inadequate and proper bacteriologic determination requires culture of the entire bone graft. Therefore, some institutions rely solely upon donor wound healing as the criterion for an acceptable bone deposit. Both of these methods have disadvantages but they have proved to be clinically worthwhile in the hands of many surgeons.

The development of a simple method of sterilizing bone grafts which would not materially damage the osteogenetic properties of the deposit or so alter it as to make it unsatisfactory in osteosynthesis would be a signal advance.

It is estimated that although frozen homogenous bone is approximately 15 to 50 percent slower in final healing than its autogenous counterpart, the end results are identical (1). Key (2) observed that procurement of an autogenous bone graft increases the gravity

<sup>1</sup>Orthopedic Service, U. S. Naval Hospital, National Naval Medical Center, Bethesda, Md.

of the operative procedure about one-third. The experimental and clinical work relating to homogenous bone grafts by Bush and Garber (3), Wilson (4), Walsh (5), Lapscomb (6), Wraver (7), Reynolds and Oliver (8), Inclan (9), and Zambron (10) indicated that the present methods of chemical and refrigerative preservation are most satisfactory. However, these present-day methods of bone preservation are only milestones in the quest for a bone graft substitute that will be perfectly and quickly revascularized, completely acceptable to the host, and readily available.

#### HISTORY

In 1867 Ollier (11) published his treatise on bone formation. His experimental and clinical observations are the basis of autogenous bone grafting as we know it today. We find the first reference to the value of refrigeration in the preservation of bone when he determined that temperatures of less than  $-16^{\circ}$  C. ( $32^{\circ}$  F.) delayed putrefaction of bone. He also found that rabbit bone kept at  $-1^{\circ}$  C. ( $30.2^{\circ}$  F.) gave a growth of bone four times greater than that of rabbit bone kept at  $5^{\circ}$  to  $10^{\circ}$  C. ( $41.0^{\circ}$  to  $50.0^{\circ}$  F.). He also commented on the practicality of using cadaver bone in human bone grafting.

Tuffier (12), in 1910 and 1911, preserved, in an ordinary ice box, pieces of human fat, bone, cartilage, and peritoneum which had been placed in petrolatum. Although there are several references in this older literature to the clinical use of this refrigerated human cartilage and peritoneum, it was noted that portions of dog periosteum, which had been kept in cold storage for from 24 to 48 hours, when transplanted under the skin of the chest of another dog would produce bone. In this same period Albee (13) published one of the first standards for the preservation of homogenous grafts. The graft was to be either immersed in petrolatum or wrapped in sterile petrolatum gauze and placed in storage at a temperature of  $4^{\circ}$  to  $5^{\circ}$  C. ( $39.2^{\circ}$  to  $41.0^{\circ}$  F.). He considered freezing undesirable as "the resultant contraction and expansion damage the cellular content of the graft" (15). Fresh and cadaver bone were successfully used after chilling for from 24 to 48 hours. That these principles have gained partial acceptance in orthopedic centers can be verified by their inclusion in the Medical Manual No. 4, *Military Orthopedic Surgery* (World War I).

In 1918, Groves (16) reported that there had been sufficient success in the use of chilled homogenous grafts to justify their employment in selected cases if the correction of a defect included all or part of the cartilaginous articular surface of the long bones. He noted that such a graft should have the articular configuration necessary for proper modeling and recommended that the graft be obtained

from a cadaver free from infectious disease; preferably one whose death was caused by trauma. After the graft was taken, it was to be cultured and placed in a sterile receptacle in an ice chest and after 24 hours, if the culture was negative, the graft could be used. These concepts are remarkably parallel to the present use of frozen cadaver bone.

The recommended practices of Albee and Groves did not seem to gain general acceptance, possibly because of the difficulties of procurement and of preservation. No further reports on the clinical use of bone preserved by chilling or freezing appeared in the literature until late in World War II.

In 1934, Keith (17) noted "survival" of some cells with new bone formation, following immersion of fragments of dog bone for 10 minutes in liquid air. A similar result was obtained with implantation of dog carpal and tarsal bones frozen for 10 minutes in liquid air.

Between 1931 and 1937, Orell (18) published his work on preserved heterogenous bone. He defined os *primum* as bone which, through a lengthy physicochemical process, was freed of fat, connective tissue, and protein; however, it was not entirely freed of all collagenous matrix. Os *novum* was then produced by subperiosteal implanting with subsequent grafting after 1 to 2 months.

In 1937, Smith (19) reported two successful homogenous grafts in nonunion of fractures in osteogenesis imperfecta. The bone was refrigerated for preservation and autoclaved immediately before use.

Inclan (9) in 1942, was the first to utilize refrigeration in the preservation of homogenous bone for an appreciable number of bone grafts. He utilized these preserved homogenous grafts in 8 cases, 6 of which were successful; preserved autogenous bone was used for the remaining 46 grafts. The transplant was placed in a sterilized glass container and covered with the patient's own blood or that of a donor of the same group. The maximum preservation time was 63 days. The minimum was 3 days and good or excellent results were obtained in approximately 75 percent of the cases.

In 1942, Smith (20) employed homogenous bone refrigerated 18 days with apparently satisfactory results.

The advent of better refrigeration methods and the mass production of antibiotics proved to be a great stimulus to bone graft surgery and resulted in the increased use of frozen bone transplants.

A type of frozen-bone bank was initiated by Bush and Garber (3) (21) in 1945. It was prompted by a need for additional bone for orthopedic procedures involving extensive spinal fusions for severe scoliosis, low back disorders, filling of bone cysts, and the replacement

of other benign defects in bone. At first, bone was preserved at temperatures ranging from  $-2^{\circ}$  to  $-5^{\circ}$  C. ( $28.4^{\circ}$  to  $23.0^{\circ}$  F.); however, it was observed that bone could be preserved for only 2 or 3 weeks. Following experimental studies in animals it was found that  $-24^{\circ}$  C. ( $-11.2^{\circ}$  F.) was probably the optimum temperature for prolonged preservation of bone for grafting purposes. In 126 procedures in which the frozen homogenous graft was used, they noted 2 infections, 1 fracture of an onlay graft, and 1 failure because of inadequate soft tissue coverage. In an effort to maintain strict asepsis, the fresh graft (without preservative) was placed in a double jar (a small jar within a large one) and covered with a sterile rubber dam.

Subsequently, Wilson (4) reported 30 surgical procedures in which fresh bone without preservative added was placed in a single sterile sealed jar and frozen at  $-22^{\circ}$  to  $-30^{\circ}$  C. ( $-7.6^{\circ}$  to  $-22.0^{\circ}$  F.). No infections were reported and in all cases "its behavior seemed to be identical to that of the fresh autogenous bone." At a later date, Wilson reported over 200 cases of the clinical use of frozen bone with satisfactory results; the infection rate was approximately 2 percent.

Walsh (5), working independently, presented a similar method of preserving bone by refrigeration. This work is the best review of the fundamentals of the use of freezing temperatures in the prolonged preservation of bone.

The impetus given to the use of frozen bone by the previous workers cannot be underestimated. In 3 years, the bone bank has grown from an experiment to an established orthopedic practice, even though the indications for the use of frozen bone are subject to limitations.

#### THE ACTION OF REFRIGERATION IN THE PRESERVATION OF BONE

According to Walsh (5) the changes which occur in stored bone may be classified into two groups: (a) biochemical changes in the activity of the enzymes of the bone itself; and (b) changes due to the action of putrefactive bacteria. To this may be added (c) changes in the bone due to mechanical action of freezing.

Lipsecomb (6) has demonstrated that alkaline phosphatase activity is demonstrable after 2 to 3 weeks of bone storage at temperatures of  $-10^{\circ}$  C. ( $14.0^{\circ}$  F.). Gross, histologic, and chemical examinations following experimental procedures in rabbits indicate that the activity of this enzyme has no notable effect upon the final healing of the frozen bone graft. Frozen specimens examined grossly, microscopically, and by olfaction revealed no evidence of putrefaction. Weiver (7) who has used frozen homogenous bone successfully after 708 days' storage in an ordinary ice-cream cabinet noted no gross changes. Walsh found that bone removed aseptically from an ampu-

tated limb and stored for 10 months at  $-22^{\circ}$  C. ( $-7.6^{\circ}$  F.) revealed no gross changes.

It is possible that partial protein denaturation occurs in the bone as a direct result of freezing. Hardy (22) observed that gels, which were singularly refractive to polarized light previous to freezing, became doubly refractive during the frozen state. It is known that "freezing and thawing alter the configuration of colloidal systems whether gels or sols and the resulting structures depend upon the rate of freezing" (23). This is evidence that the colloidal molecular structure impairment is permanent. In a bone transplant, autogenous or homogenous, it is possible that the organic fraction of the calcium proteinate may be an important factor in facilitating the subsequent revascularization of the graft. Perhaps freezing alters the osseous protein and if we consider that the majority of all transplant grafts die, this may explain the estimated 15 to 50 percent delay in healing after the use of frozen bone grafts. Moran (23) has noted that the temperature at which the mixture of colloid and ice forms must be lower than the external temperature due probably to the low diffusibility of the colloid complexes. Hardy (22) found that gels at 65.6 percent concentration could not be made to freeze.

These observations have been applied to frozen bone on the basis that bound water is intracellular and cannot be frozen; and interstitial water is not so bound to protein and hence can be frozen (22). Further the internal friction increases as the colloid concentration increases and as the temperature falls. This is the result of the inability of ice-forming sources to overcome internal friction (22) and this prohibits intracellular freezing. Stiles (24) believes that the cellular death of the tissue kept at freezing temperature occurs because of formation of ice crystals which alter the space relation of the phases constituting the normal colloid complex of protoplasm.

On the basis of the foregoing, we may conclude that, at the usual bone bank temperatures, freezing of bound water does not occur nor is there serious protein denaturation, and since the potential value of any graft conceivably exists in the protein fraction of the calcium proteinate, the physiologically important protein fractions of the donor bone are preserved. This explanation may be the reason that bone grafts can be preserved by freezing (fig. 1) and in addition offers an explanation for the delay in final bone healing when using frozen bone.

Strumia, McGraw, and Reichel (25) have given additional proof of the relationship of cold to colloid preservation by demonstration that, under refrigeration, it is possible to retain the physicochemical properties of complex colloids. The essential conditions are rapid

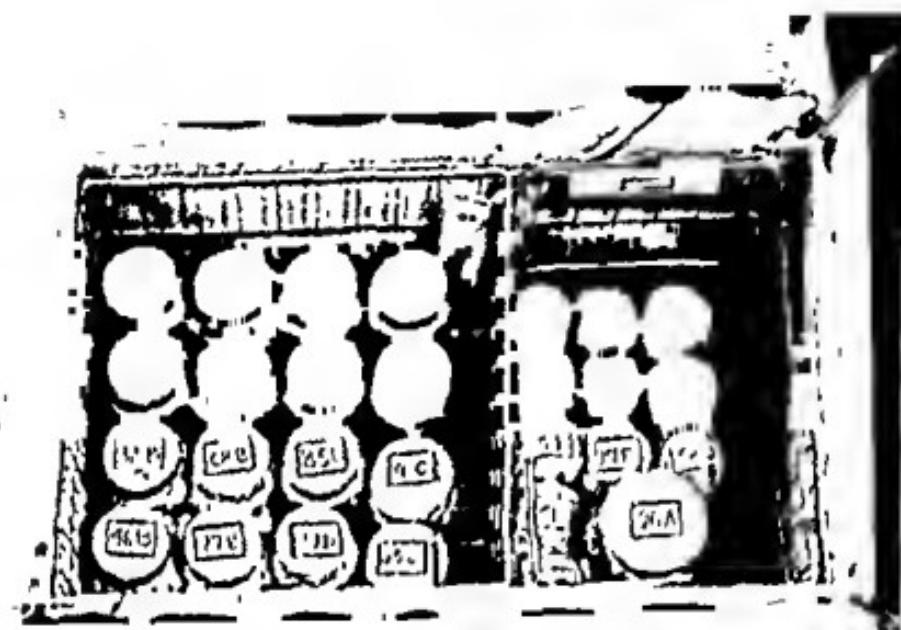


Figure 1.—A typical bone bank.

freezing, maintenance of a temperature below  $-15^{\circ}\text{ C}$ . ( $5.0^{\circ}\text{ F}$ .), and rapid thawing followed by a quick warming to  $98^{\circ}\text{ F}$ . They also stated that plasma stored at  $4^{\circ}\text{ C}$ . ( $39.2^{\circ}\text{ F}$ .) gradually lost the entire protein fraction; however at  $-15^{\circ}\text{ C}$ . ( $5.0^{\circ}\text{ F}$ .) this did not occur. Finn (27) has shown that the protein of juice of muscle stored at  $-1^{\circ}$  to  $-3^{\circ}\text{ C}$ . ( $30.2^{\circ}$  to  $26.6^{\circ}\text{ F}$ .), underwent denaturation of protein up to 10 percent of the volume. If muscle juice was stored at  $-20^{\circ}\text{ C}$ . ( $4^{\circ}\text{ F}$ .), only 1 percent was denatured; this occurred early and remained constant up to 75 days. Of course, bone protein is not exactly the same as that of blood and muscle juice, however, fundamentally similar proteins tend to follow the same chemical laws.

It appears, therefore, that the optimum temperature for prolonged bone preservation is in a range with a minimum of  $-15^{\circ}\text{ C}$ . ( $5.0^{\circ}\text{ F}$ .), and the maximum so much colder that it is yet to be determined.

#### EFFECT OF RETROGRESSION ON BACTERIA

Haines (28) has demonstrated that the critical zone for bacterial survival lies in the temperature range of  $-1^{\circ}$  to  $-2^{\circ}\text{ C}$ . ( $30.2^{\circ}$  to  $28.4^{\circ}\text{ F}$ .). The rate of death at  $-1^{\circ}\text{ C}$ . ( $30.2^{\circ}\text{ F}$ .), was definitely more rapid than at  $-5^{\circ}\text{ C}$ . ( $23.0^{\circ}\text{ F}$ .); there was little variance in the death of the bacteria evaluated. No evidence has been presented that

a bactericidal effect is associated with the rapidity of the freezing process. The sensitivity of bacteria to cold varies greatly; for example, a suspension of *Bacillus pyocyanus* frozen rapidly to  $-70^{\circ}$  C. ( $-94.0^{\circ}$  F.), when thawed showed that approximately 80 percent of the organisms had been killed. Similar treatment of *Bacillus mesentericus* (a spore-former) killed none.

Turner (28) has demonstrated that spirochetes are only slightly adversely affected by temperatures as low as  $-78^{\circ}$  C.; however, at higher temperatures,  $-10^{\circ}$  to  $-20^{\circ}$  C. ( $14.0^{\circ}$  to  $4.0^{\circ}$  F.), loss of the spirochetes occurred during storage periods.

As a rule, viruses placed in glycerin and maintained at freezing temperatures will remain virulent for a number of weeks; however, there seems to be a considerable fall in titer from that of the fresh specimens. Viruses, such as human influenza, yellow fever, and certain types of encephalomyelitis when frozen and maintained at  $-78^{\circ}$  C., have substantially the same titer after 6 months.

The personal experiences of the author and Dr. A. D. Kenton<sup>2</sup> showed that stock cultures of hemolytic *Staphylococcus aureus* and hemolytic streptococci when placed in the bone bank and kept at  $-20^{\circ}$  to  $-30^{\circ}$  C., revealed a heavy growth of organisms when cultured at weekly intervals for 4 weeks and monthly intervals for 6 months.

From this evidence, it is apparent that the temperature required for adequate bone preservation is bacteriostatic and probably mildly bactericidal.

#### THE EFFECT OF REFRIGERATION ON MALIGNANCY

The transmission of malignancy by inoculation from one human to another has not, to the author's knowledge, been conclusively proved. The effect of cold upon the transmissibility of human malignancies could not, therefore, be evaluated in the light of clinical experience.

For this reason we have turned to the noteworthy results of the experimental surgeons. Breedts, Barnes, and Furth (29) have demonstrated the viability of mouse sarcoma frozen at  $-30^{\circ}$  to  $70^{\circ}$  C., for 56 days. Their findings indicated that the transmission of leukemia and tumors in frozen tissue is due to the survival of neoplastic cells. Mider and Morton (30) using strains of sarcoma and carcinoma found that after freezing rapidly at  $-74^{\circ}$  C., carcinoma transplants gave 45 to 50 percent successful results and the sarcoma gave 85 to 90 percent successful results. Klinke (31) observed that transplantable carcinoma and carcinoma would grow after freezing to  $-250^{\circ}$  C. Greene (32) believes that the transfer of bone or any other tissue from a cancer

<sup>2</sup> New England Deaconess Hospital, Boston, Mass.

patient to a normal person carries with it the danger of transferring malignant cells (even if the selected bone is apparently well away from the primary malignancy) and that some malignant osteogenic tumors kept at  $-25^{\circ}$  C., will survive and grow when transplanted to animals. Since many patients who have a malignancy may have segments of normal-appearing bone removed during the course of definitive or palliative surgical procedures, the previous admonition is timely. Coley and Higinbotham (33) have used normal-appearing ribs removed during thoracotomies for mediastinal tumors (the majority of which were malignancies) in 16 cases with no unsatisfactory results in short-term follow-ups.

#### THE MERTHIOLATE BONE BANK

This method for the chemical preservation of homogenous bone was developed by Reynolds and Oliver (34). It is similar to the method used for the successful preservation of cartilage. The bone is removed aseptically at operation or autopsy; all soft tissue is removed, the marrow cultured, and the bone transplant is then placed in an aqueous solution of 1:1000 merthiolate for 2 weeks. The bone is then removed from the antiseptic solution, recleaned and recultured under aseptic conditions. This step is necessary, for the mode of action of the antiseptic is protein coagulation and considerable glutinous debris accumulates. The bone is then placed in a 1:5000 solution of merthiolate which is changed monthly or biweekly for the purposes of cleanliness. After two negative cultures, the graft may be used. Reynolds and Oliver (8) found that grafts preserved in merthiolate solutions were morphologically similar to autogenous grafts preserved under similar conditions and in some respects were better than frozen grafts. In 71 cases in which the merthiolate grafts were used, 42 were reported successful. The advantages of this method lie in its ready availability, its inexpensive material, and its simple space requirements. It is also being used in those cases in which infection may recur (35).

The writer believes the following considerations are to be noted:

- (a) Transferring the bone from a 1:1000 solution to a 1:5000 solution of merthiolate can be compared to transfer from a distinctly bactericidal solution to a much less bactericidal solution.
- (b) The bone is subsequently removed from the 1:5000 solution biweekly for cleaning purposes and thus exposed to the open environment and, just as in other operative procedures, contamination is possible.
- (c) Cultures of bone fragments are not considered to be adequate evaluations of the possible contamination of the deeper portions of any bone. The antiseptic action of the mercurial is dependent upon its ability to coagulate protein. This results in a surface film of protein coagulum

which permits minimal surface penetrations and is easily washed off. The antiseptic value of this bone is questionable when it is placed in the host for the protective and antiseptic-impregnated surface film is usually washed off as a preliminary to surgical installation.

The value of such mercurials apparently is in their preservative actions and their slight to moderate bactericidal value for the protein coagulum is not only bactericidal but may act as a seal preventing excessive tissue dehydration.

#### THE SURGICAL USE OF PRESERVED BONE GRAFTS

Frozen bone is most commonly applied in the form of chips, slivers, and crumbs. These are of value in such procedures as fusions for scoliosis, severe instability of the lumbosacral articulations, and spondylolistheses. In addition, the implantation of cancellous and cortico-medullary crumbs as an adjunct to fracture treatment by internal metal fixation is a growing practice. This is in keeping with published reports of satisfactory chip-graft results in the experimental animal as well as in man. To date, no experimental evaluation of largo preserved homogenous grafts has been reported. Accordingly the use of this type of cortical grafts has not enjoyed the popularity of the smaller cancellous graft. Weaver (7) has used corticomedullary preserved bone grafts with equivocal results in some cases. One fundamental to be learned from the preceding is that frozen grafts should not be expected to perform well physiologically when fresh grafts have previously failed under similar circumstances.

#### DISCUSSION

- (a) Preserved grafts are not satisfactorily revascularized nor as much of a host stimulus as are the autogenous counterparts. (b) Some orthopedic surgeons fear that these preserved graft substitutes will not be adequately revascularized and that, if revascularized, the grafts may not be as acceptable to the host and will "melt away" as does human homogenous skin grafts. (c) Other groups believe that not only is it undesirable to take bone from the same patient but also that the free and easy access of bone replacement may prompt unnecessary surgery. (d) Some surgeons consider that the present clinical indications are not inclusive enough to warrant the expense of bone bank equipment and the assignment of personnel. (e) The shortage of qualified personnel to assume the responsibilities and duties of administration of a bone bank and, in addition, the necessity of training technicians is, at present, a very practical disadvantage. (f) The lack of standardization of indications, methods, and forms

for bone-bank deposits and withdrawals necessitates considerable loss of time of qualified personnel.

Basically, it is proved that the smaller sections of preserved bone are not only physiologically acceptable but also they are completely albeit slowly revascularized. Since the concept of the bone bank over 5 years ago, there have been no reports indicating graft disappearance or "melting" other than that expected with comparable fresh autogenous graft. The infection rate has not exceeded that expected from any other orthopedic procedure. Wilson (4) reported infections in 2 percent in over 200 consecutive cases in which frozen bone was employed. In our experience, the use of a frozen-bone graft with minimal soft-tissue dissection at the operative site is of noteworthy value. Not only has the average operating time been shortened by at least 30 percent but there is less postoperative pain, and the need for sedatives is proportionately diminished. The convalescence is shortened since there is only one operative site to consider. The chronic pain which often characterizes donor sites is now no problem. Supportive measures, such as blood transfusions, that were previously routine in major bone-grafting procedures, are now the exception rather than the rule.

#### CONCLUSIONS

Frozen bone appears to serve the functions demanded of an osteoplastic transplant and has additional values also, for it acts not only as a "filler" for an osseous defect but it also stimulates active bone formation on the part of the host. It may serve the demands of osteosynthesis and, in addition, stimulate osteogenesis. While frozen homogenous bone is not revascularized as well as its fresh autogenous counterpart and, in the frozen cortical homogenous grafts, the delay may be considerable (7), it will ultimately be identical with the host. These factors limit the clinical indication for preserved bone.

The smaller orthopedic institutions would benefit by watchful waiting until development of the present trends in the use of frozen-bone grafts which is having a major trial in the larger institutions. As results are published, the acceptance or rejection of the use of preserved homogenous bone could then be made to fit the needs.

The future of the use of preserved bone, if scientifically controlled, vigorously pursued, and applied with considered and mature surgical judgment, may prove to be of value to every orthopedic surgeon.

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# Osteitis Fibrosa Cystica of the Rib

THOMAS B. WIPER, M.D.<sup>1</sup>

JOSEPH M. MILLER, M.D.<sup>2</sup>

**P**RIMARY tumors of the ribs are rare in contrast to metastatic lesions. All types of primary osseous and cartilaginous growths which affect other bones may be found in the ribs. Harper (1) reviewed the literature on primary, benign tumors of the ribs and found only 87 cases; these included 60 chondromas, 11 giant cell tumors, 9 fibromas, and 7 osteomas. He added one case of chondroma and one case of myxomatous degeneration of a chondroma or latent bone cyst that he considered a form of osteitis fibrosa cystica. Schilimborg (2) recently reported 67 patients with fibrous dysplasia involving a single bone, 29 of whom had a lesion in a rib.

The diagnosis of a solitary tumor of the rib is often difficult. The history of the patient varies; the patient may complain of pain or may be asymptomatic. Physical examination may be unrevealing as the tumor may not be palpable. A careful search for a primary tumor should be made in all parts of the body. Often, the tumor is discovered when a roentgenogram of the thorax is made. Whenever a tumor of a rib is found it should be considered malignant until proved otherwise. The following examinations should be made: a careful study of the formed elements of the blood; the value of the serum proteins, serum calcium, blood phosphorus, and plasma alkaline phosphatase should be determined; a serologic test for syphilis should be made; and the urine should be tested for Bence-Jones protein. A roentgenologic survey of the skull, vertebrae, pelvis, and long bones to find other tumors is extremely valuable in making a diagnosis. If the results of these examinations are negative, a resection of the rib extending beyond the neoplasm should be performed.

We have studied three patients with isolated rib lesions. In each patient, a diagnosis of osteitis fibrosa cystica or fibrous dysplasia was made.

<sup>1</sup> San Francisco, Calif.

<sup>2</sup> Fort Howard, Md.

## CASE REPORTS

**Case 1**—The patient, a 19-year-old Negro, was returned from overseas because of a psychoneurosis. He did not have any symptoms referable to his chest, and no tumor was palpated in the thoracic wall. A routine roentgenogram of the thorax (fig 1A) disclosed normal lung fields and a tumor measuring 5 by 2.5 cm in the right sixth rib in the posterior axillary line. The cortex of the rib was greatly expanded. The central portion of the tumor was radiolucent with numerous, small trabeculations dividing the space into compartments. A roentgenographic skeletal survey was made but no other lesions were found. The laboratory findings were normal.



*Figure 1—Case 1. (A) Roentgenogram of the thorax showing cystic lesion in right sixth rib. (B) Roentgenogram of the specimen. (C) Longitudinal section of the specimen.*

Thoracotomy, with resection of about 10 cm of the right sixth rib, including areas beyond the tumor, was performed. The affected rib was exposed in the posterior axillary line and the bone, the adjacent intercostal bundles, and the underlying pleura were explored.

The postoperative course was complicated by subcutaneous emphysema and a small amount of atelectasis in the middle lobe of the right lung and the lower lobe of the left lung. After coughing and expectoration of tenacious sputum, aeration became complete. The wound healed uneventfully.

On gross pathologic examination, the resected portion of the rib was found to be about 10 cm long. It presented an expansile central portion with a spindle deformity of the ribs to about three times the normal diameter (fig 1C). On section the bone was soft, the cortex thin, and at the greatest diameter looked as though the rib was fractured and partially healed. The central portion of the tumor was occupied by a soft gray mass, and arranged in convolutions about more vascular cores. The tumor was in the expanded central area of the rib and the resection extended beyond the tumor. A roentgenogram of the specimen is shown in figure 1B. Microscopic examination of the tumor revealed an intense loose fibrosis of the medullary spaces with active osteoplasia and no evidence of new bone formation. Foci of osteoplastic giant cells were seen, and in these areas the tissue was slightly more compact and contained numerous polymorphonuclear neutrophils. No evidence of carcinoma was found.

**Case 2**—The patient was a 37-year-old white soldier who was transferred to a medical hospital with a diagnosis of mild myocarditis. The patient had suffered

a compressive injury of the thorax 10 years previously and had received treatment for a fracture of a rib at that time.

No tumor was palpated in the thoracic wall. No cardiac disease was found. The laboratory findings were normal. A roentgenogram of the thorax (fig. 2*A*) revealed normal lung fields and a large cystic area in the left seventh rib near the posterior axillary line. No destruction of the cortex was seen, but the upper corner of the cortex seemed to be broken, apparently from pressure. A roentgenographic skeletal survey did not reveal any other tumors.

Thoracotomy with resection of about 20 cm. of the left seventh rib was performed. The rib, adjacent intercostal bundles, and the underlying pleura were removed in one mass. The postoperative course of the patient was complicated by an attack of bronchitis that responded to penicillin. The wound healed uneventfully.

The specimen consisted of a segment of rib about 20 cm. long, the center of which was occupied by a spindle-shaped, symmetrically expanding mass (fig. 2*B*). The cortex of the bone seemed to be normal in thickness. The medullary cavity was occupied by a soft, gray-pink mass containing numerous spicules of bone. The gross configuration of the tumor was not remarkable. The tumor filled the expanded portion of bone evenly and extended into the shaft of the bone in both directions. A roentgenogram of the specimen is shown in figure 2*C*. Microscopic examination revealed the marrow cavity to be completely filled with intermingling sheaths of fibroblastic cells having a large number of collagenous processes. There was some evidence of osteolysis and more evidence of the formation of new bone along preexisting trabeculae. Mitoses were not seen. The cortex of the rib was not infiltrated or perforated.



Figure 2.—Case 2. (A) Roentgenogram of the thorax showing cystic lesion in left seventh rib. (B) Longitudinal section of the specimen. (C) Roentgenogram of the specimen.

**Case 3.**—The patient, a 23-year-old Negro, was returned from overseas because of pain of increasing severity in the anterior portion of the right side of the chest over the costal margin. The pain which was present during rest was aggravated by exercise. A slight, nonproductive cough had been present for about 4 months. The patient had suffered a compressive injury to his chest in an automobile accident about 3 years previously.

Physical examination was essentially normal except for moderate tenderness over the right seventh rib in the anterior axillary line. No tumor was palpated



A



*Figure 3.—Case 3. (A) Roentgenogram of the thorax showing cystic lesion in right seventh rib. (B) Longitudinal section of the specimen. (C) Roentgenogram of the specimen.*

in the thoracic wall. The laboratory findings were normal. A roentgenogram of the chest revealed normal lung fields and an area of cystic expansion in the right seventh rib in the anterior axillary line (fig 3A). The cortex of the bone around the tumor was thin and numerous, small, fine trabeculations of bone were present within the expanded area. The process seemed rather sharply demarcated and involved a segment of bone about 5 cm long. No break in the cortex was seen and no soft tissue mass was present. A roentgenologic skeletal survey did not disclose any other tumors.

Thoracotomy with resection of about 12 cm of the right seventh rib, including an area extending beyond the tumor, the adjacent intercostal muscle bundles, and the underlying pleura was performed. The postoperative course was complicated by a moderate pneumothorax, but reexpansion of the underlying lung was rapid and complete. A slight atelectasis was seen in the lower lobe of the left lung but this cleared rapidly. The wound healed uneventfully.

The resected portion of rib was about 12 cm long (fig 3B). Near one end and opposite the cartilaginous insertion was a cystic cavity with smooth walls that contained a small amount of clear, yellow fluid. The marrow was fibrous for a distance of about 8 cm but was otherwise normal. Roentgenograms of the specimen are shown in figure 3C. Microscopic examination revealed a loose pack of stellate cells having long processes and separated by a loose, fine, fibrous substance that completely replaced the marrow. Moderate osteolysis and osteoclasts were present. The cortex was thin and the periosteum had an appearance not unlike that of the tumor, but was more compact. No mitoses were found. In the central portion of the mass was a cystic space lined by a thin, flat, single layer of fibroblasts. The surrounding area was composed of compressed tumor stroma in which there were areas of recent hemorrhage. A section taken through

the osteochondral junction showed the medullary lesion to be sharply demarcated from the normal marrow, but the tumor seemed to be present under the periosteum at this point, and extended to the area of cartilage.

#### DISCUSSION

The three lesions that have been described have no connection with those encountered in the generalized type of osteitis fibrosa cystica caused by adenoma or hyperfunction of the parathyroid glands. The term osteitis fibrosa has been loosely used to refer to all types of bone cyst. With a better understanding of the underlying pathologic changes it has been possible to isolate the particular type of lesion under discussion from the heterogeneous group loosely referred to as osteitis fibrosa cystica. The prime factor in the production of these lesions appears to be trauma. A history of compressive injury to the thorax was obtained in cases 2 and 3.

A consideration of these three lesions reveals that the fundamental changes are those observed in the ordinary repair of bone with a slightly different phase being seen in each case. Geschickter and Copeland (3) (4) (5) have presented the main phases of the problem in their articles on osteitis fibrosa and giant cell tumor. They consider trauma a primary cause of those lesions that arise at a point just beneath injured cortex. The trauma impedes the supply of blood coming from the cortex and produces a subperiosteal hematoma. This factor creates a need for collateral circulation by the medullary cavity to open up new channels in bone for the budding capillaries. The same authors state that this increased osteoclastic activity, in an area where the osteoclasts are already unusually active in the role of new bone construction occurs just at the time when the undernourished cortical bone is undergoing necrosis. Thus an imbalance between bone destruction by osteoclasia and the formation of new bone that would normally proceed from the active cortex is present. Where the defensive reaction of the bone is poor as in the epiphysis, an unchecked hyperplasia of the giant cells occurs and tissue characteristic of a giant cell tumor results. In the metaphysis where the reactive cortical bone is thick and vascular and the tissue reaction can overtake the osteoclasia, an arrested lesion may result which exhibits the various stages of osteitis fibrosa, with and without the formation of cysts. The giant cell tumor of the epiphysis is a lesion in which the healing tendency is not present while the osteitis fibrosa represents an advanced healing stage of bone following trauma. Geschickter and Copeland (5) state that a similar reaction may occur in the small or flat bones with the production of a spindle cell variant of a giant cell tumor. Spatial limitations bring the tumor almost immediately into relation with cortical bone on all sides and an early defensive reaction that exhibits itself microscopically as a fibrous proliferation, resulting in a

so-called spindle cell variant of a giant cell tumor, occurs. The tendency toward repair, however, although invoked early, is not so distinct as in the shaft of the long bone where the cortex is thicker and more active. A partial healing process is present.

In osteitis fibrosa, the ordinary bone marrow is replaced by fibrous tissue containing ovoid and spindle cells and, in some cases, many blood vessels. This vascular connective tissue may assume the appearance of ordinary fibrous tissue or have a whorled arrangement. Numerous scattered foci of new bone may be present. Areas of giant cells are found when the proliferative processes are most active. Evidence of hemorrhage may be seen. These findings are those of a healing reaction in bone. Geschickter et al. (3) write that varied microscopic appearances, depending on the type of bone affected, the specific site of a long bone involved, and the age of the patient, will be seen.

The roentgenogram of osteitis fibrosa reveals an expansile lesion of the bone marrow with extreme thinning of an intact cortex. The central portion of the tumor is radiolucent with numerous small trabeculae dividing the marrow into compartments.

Having performed the various diagnostic tests enumerated, a differential diagnosis should be attempted. It is assumed that only a single lesion in a rib has been found after a thorough roentgenologic survey. The roentgenologic study will eliminate polyostotic fibrous dysplasia and hyperparathyroidism. A decision may be difficult as to whether a giant cell tumor, a spindle cell variant of the giant cell tumor, or osteitis fibrosa is present, when the diagnosis is limited to these three lesions. The diagnosis can be made only by microscopic study of the tumor, and then if different areas of the same lesion are studied, it may be realized that all of these three conditions, which are different phases of one fundamental process, are being seen.

Statistically, giant cell tumors of the ribs are uncommon. Samson and Haight (6) collected only nine cases and added one of their own. It is also difficult to find reports of osteitis fibrosa of ribs since this, too, is an uncommon lesion. This is to be expected since probably the same factor is effective in producing both lesions. An isolated pyogenic abscess of a rib is also an uncommon lesion. Physical examination revealing tenderness over a localized segment of rib, an elevated leukocyte count, with an increased number of polymorphonuclear neutrophils in the peripheral blood stream, and the roentgenogram will indicate the diagnosis.

A gamma may simulate a bone cyst. A positive serologic test for syphilis should make the surgeon suspicious that a syphilitic bone lesion is present. The roentgenogram may reveal a perforation of the expanded cortex, periosteal involvement, and sequestration. Osteo-

mas, osteochondromas, and chondromyxomas may be differentiated by roentgen examination. In many of these cases, however, great difficulty in making an exact diagnosis may be encountered. Eosinophilic granuloma occurs more often in the ribs and skull, although other bones may be affected. Eighty percent of the lesions occur in children. The disease is rarely seen after the age of 25 years. All symptoms are caused by the local lesion but symptoms may be absent. The number and the morphology of the leukocytes are usually normal, although a slight eosinophilia may be present. Values for calcium, phosphorus, and acid and alkaline phosphatase in the serum are normal. On the roentgenogram, a rarefied area with erosion of the cortex and perhaps fracture may be seen. The diagnosis is difficult and removal of a specimen for biopsy or, in the case of a rib, excision may be indicated to obtain material for microscopic study.

A multiple myeloma will usually reveal itself by increased total blood protein values, the presence of Bence-Jones protein in the urine in some, not but all cases, and multiple areas of bone destruction. Instances of myeloma affecting only one bone have been reported but eventually the true nature of the disease will be recognized. A single destructive lesion in a rib may represent a metastatic deposit from a carcinoma elsewhere in the body and a careful roentgenographic survey that includes examination of the pulmonary, gastrointestinal, and genito-urinary tracts, may disclose the primary lesion. In some cases it may be impossible to find the primary lesion on the initial examination. Removal of the affected rib and microscopic examination may reveal a malignancy, although its source may remain unknown for a long time.

Tumors of the intercostal nerves may simulate neoplasms of the ribs both clinically and roentgenologically. Intrathoracic tumors of nerve or tumors of the posterior mediastinum may occasionally be mistaken for neoplasms of the ribs.

Having arrived at a tentative diagnosis the surgeon is confronted with a problem of therapy. If the diagnosis can be definitely established as osteitis fibrosa, there is no need for operation. Mallory (7) states: "There is no record of a case of fibrous dysplasia that was followed by osteogenic sarcoma or other form of malignant tumor, so that there is no probability of harm to the patient if it is left untreated." Since, however, an absolute diagnosis can rarely be made, removal of the affected rib is usually indicated.

#### SUMMARY

Lesions of osteitis fibrosa cystica of a rib are usually discovered on routine roentgenographic examination of the thorax. A history of trauma to the thorax is obtainable in many instances. The values for

serum calcium, phosphorus, and blood alkaline phosphatase are within normal limits. It is difficult to differentiate the variants of fibrous dysplasia preoperatively. When possible, these lesions should be removed because of the difficulty in making a definite diagnosis. The operative risk is slight.

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# An Epidemic of Vomiting and Diarrhea

DWIGHT M. KUHN,*Colonel, MC, U. S. A.*<sup>1</sup>

DONALD G. WETHERBY,*Captain, MC, U. S. A.*

DURING the fall and winter of 1948 epidemics of acute gastro-enteritis occurred in the San Antonio area. The disease was characterized by sudden onset of nausea, vomiting, and diarrhea, and was usually accompanied by a low fever. Respiratory symptoms were usually absent. In most patients the course was brief and the symptoms subsided within 24 to 72 hours. In a few patients the fever and symptoms persisted for a week. No sequelae were observed. Since the disease was comparatively mild and of short duration, only a few of the patients consulted a physician and accurate figures on the incidence were not obtained. In this same period the State Health Department of Texas reported a high rate of dysentery. Their cases were probably related to ours since the majority were not confirmed by laboratory findings. Investigation showed that if one member of a family contracted the disease, the other members usually acquired it within the next 3 days. This would suggest a short incubation period, but the syndrome was so widespread and contacts so numerous that no definite conclusions could be drawn.

The syndrome has been variously called "intestinal flu," "virus vomiting and diarrhea," "epidemic diarrhea," "nausea and vomiting," "stomach flu," and "seasonal gastro-enteritis." Because of the wide distribution, the relatively mild character of the symptoms, and the prompt recovery without sequelae, it should be sharply differentiated from so-called "infant diarrhea," the effects of which are often pernicious and prolonged. Clinically, this outbreak corresponded closely to the epidemic of anorexia, malaise, diarrhea, nausea, and vomiting that occurred in October and November of 1943 and 1944 in two boarding schools in Philadelphia (1). A series of similar outbreaks occurred in New York City in the fall and winter of 1946-47 (2). We have analyzed a series of 13 cases.

<sup>1</sup>Fourth Army Area Medical Laboratory, Brooke Army Medical Center, Fort Sam Houston, Tex.

## SYMPTOMS

*Vomiting, nausea, and anorexia.*—Twelve of the thirteen patients exhibited one or more of these symptoms, and it is estimated that about the same proportion holds for the whole group. The onset of vomiting was sudden, was frequently severe and continued for from 8 to 10 hours. The vomitus usually was clear and watery and contained no blood.

*Abdominal cramps and diarrhea.*—Five of our patients did not exhibit either of these symptoms, and we estimate that this same proportion held for the whole group. When diarrhea occurred, it usually followed the vomiting. The stools were watery, profuse, yellow, and contained no blood or mucus. The responsible agent showed a pronounced tropism for the gastrointestinal tract. The liver and spleen were not enlarged in the patients examined.

*Malaise, chills, and weakness.*—These symptoms appeared in 11 of the 13 patients. Many also complained of muscular aches, usually in the legs and back during the acute episode. These symptoms prompted the diagnosis of "intestinal flu." A few patients complained of generalized stiffness and soreness associated with general and orbital headaches.

*Respiratory symptoms.*—These occurred in only 4 of the 13 patients and, when present, varied from a slight serous nasal discharge to a moderately sore throat.

*Temperature.*—Since few of the patients were hospitalized, temperature charts were not available. Temperatures in those patients whose temperatures were taken were between 99° to 103° F. The fever rarely lasted longer than 24 hours.

## LABORATORY FINDINGS

Four patients had a leukocytosis. The percent of polymorphonuclear cells was normal or slightly increased. All of these counts were performed in the first few hours of the disease.

All throat cultures were negative for pathogens. Agglutination-inhibition tests for influenza types A, A', and B, performed on sera drawn in the acute phase, and 7 to 10 days later, uniformly failed to give a diagnostic rise in titer for any of the strains. Lennette states that in California in 1948 he found proved cases of influenza type A and, simultaneously, cases of vomiting and diarrhea that were negative for known serologic types of influenza (3). Agglutinations for *Salmonella schottmuelleri*, *Salmonella paratyphi*, and *Brucella abortus* were negative.

One patient gave a cold agglutinin titer of 1:128 on the first day of the disease but his convalescent serum was negative. In view of the

fact that he had a respiratory infection a week previously, and that cold agglutinins usually do not appear until five or more days after the onset of primary atypical pneumonia, these agglutinins probably were unrelated to the acute gastrointestinal episode. None of the other patients had significant cold agglutinin titers.

Unfortunately stool specimens were not obtained in a significantly large number of cases. Because of the widespread occurrence of the disease it was not considered to be of bacterial (*Salmonella* or *Shigella*) origin. Bacteriologic studies for enteric pathogens in the cases studied by Reimann and coworkers (1) and Gordon et al. (2) were negative.

**Age.**—The ages of our patients (in contrast to diarrhea of the newborn) ranged from 9 to 60 years; but a few cases were reported in younger children and infants. No definite variation in severity was observed in different age groups, but frequently there was variation in severity among the members of a family.

#### TRANSMISSION EXPERIMENTS

Reimann, Price, and Hodges (4) attempted unsuccessfully to isolate a filtrable agent from adults with nausea, vomiting, and diarrhea in the Philadelphia epidemic. Stool supernates were inoculated orally, intranasally, and rectally; pharyngeal washings in bouillon were inoculated intranasally; and Berkefeld (normal) filtrates (both pharyngeal washings and stools) were inoculated intracerebrally in young mice. The results were not significant. These investigators then used the technique of Light and Hodges (5) (who had reported isolation of a filtrable agent causing diarrhea in newborn calves from patients with epidemic diarrhea of the newborn), but were unable to duplicate their results. Reimann concluded that perhaps (a) the virus had disappeared during preservation of the frozen stools, (b) the virus was never present in the stools, (c) insufficient amounts of inoculum were used, or (d) the disease with which he dealt in the adults was different than that in the newborn.

Later, Reimann, Price, and Hodges (6) experimented on human volunteers. Among 32 volunteers who inhaled nebulized filtered garglings, symptoms developed in 17. Of the 21 who inhaled nebulized stool filtrates, 11 developed symptoms. No attacks occurred in 6 volunteers who were fed serum nor in 24 volunteers who were fed serum or filtrates of garglings or stools. The conditions of the experiment were not ideal since isolation of the volunteers was not possible. Furthermore, a declining natural epidemic was present in the population used at the time the experiments were performed. Of the combined group of 53 volunteers, 28 (53 percent) developed symp-

toms as compared with 22 out of 240 (9 percent) of the remainder of the group studied in which the natural disease apparently occurred during the period of the tests. Reimann and his associates believe that the difference is significant and that the tests suggest that the causative agent of the disease is filtrable, air-borne, enters through the respiratory tract, and is present in the oropharynx, but not in the blood.

Gordon, Ingraham, and Korns (2) likewise obtained negative results in experimental animals and successful transmission in human volunteers, but their experience was the reverse of that of Reimann. They were able to transmit the disease without difficulty using stool filtrates administered orally, and were able to transmit the disease by feeding filtered throat washings, but they were unable to duplicate the experiments using nebulized throat sprays of throat washings. Their experiments were well controlled. The incubation period of the experimentally induced disease ranged from 1 to 5 days, compared with 1 to 21 days in Reimann's experiments. Gordon concluded that different etiologic agents were responsible for the disease studied by Reimann, and stated that variations in the epidemiologic and clinical pattern of outbreaks investigated by the State Health Department of New York suggest that gastro-enteritis may be caused by more than one unrecognized agent. This may explain the discrepancies between the respective results, but technical and control factors may be responsible.

Throat washings obtained early in the course of the disease in the San Antonio patients were filtered and administered orally and intranasally to mice with negative results. Filtered throat washings had no effect on embryonated hen's eggs when administered by the yolk sac, amniotic, and allantoic routes. One monkey, fed filtered, bacterially sterile throat washings, developed a transient diarrhea without fever on the second day of inoculation, but the results could not be repeated, nor could the monkey material be passed serially, so that the results were inconclusive. Corneal inoculations of rabbits with throat washings by the technique of Buddingh and Dodd (7) were negative.

Through the cooperation of the Department of Preventive Medicine of the University of Texas we attempted transmission experiments in a small series of human volunteers. Five young men were examined thoroughly and found physically normal. None had had a respiratory or gastrointestinal disease within the previous 6 months. After a period of isolation of 3 days, four of these volunteers gargled and then swallowed 5 ml. each of pooled filtered throat washings from two of our patients. The other volunteer was given no inoculum, but stayed in the isolation room with the others. All five were followed

closely for 2 weeks. None showed any symptoms of respiratory or gastrointestinal disease, and their leukocyte counts and temperatures remained normal.

#### SUMMARY

A widespread epidemic of gastro-enteritis in the San Antonio area was characterized chiefly by sudden onset of nausea and vomiting, often with diarrhea. The disease was self-limited, without sequelae, and recovery usually ensued within 72 hours. Laboratory studies have not revealed the etiologic agent. Attempts to transmit the disease to human volunteers by pharyngeal and oral administration of filtered throat washings were unsuccessful. Because of the close clinical similarity between the patients in this epidemic and others in whom a filterable agent has been shown to be responsible, the syndrome we have described is probably of viral origin.

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# Cryptococcus Neoformans Meningo-encephalitis

## Report of a Fatal Case

ANTHONY P. PRZYBYLA, Lieutenant, junior grade (MC) U. S. N.<sup>1</sup>

SYSTEMIC fungus disease is not common and consequently is often overlooked, especially in its earliest stages. Furthermore, the isolation of the suspected organism may prove difficult in life and may not be achieved prior to necropsy.

Among the rarest of pathogenic fungi that may lead to fatal infection is *Cryptococcus neoformans*. Up to the present time about 100 cases of cryptococcosis have been reported. This fungus has a particular affinity for the central nervous system. Von Hansemann (1) in 1905, was the first to record the lesions of cryptococcosis or torulosis, but it remained for Stoddard and Cutler (2) in 1916, first to describe adequately the clinical and pathologic findings. They differentiated infection due to coccidioides, yeast, and *Candida* organisms. Freeman (3) presented an excellent histologic study in 1931. A comprehensive review of the clinical features of all cases up to 1937 was reported by Levin (4). Reeves et al. (5) included the 73 reported cases up to 1941 and added 6 of their own.

A case in which the diagnosis was not definitely established until necropsy is reported.

### CASE REPORT

P. I. C., a 42-year-old white man was admitted to the United States Naval Hospital, Bethesda, Md., on 15 October 1948, complaining of recent weight loss, general malaise, headache, nausea, and emesis which began 1 week prior to admission.

He appeared ill and poorly nourished. His initial temperature, pulse, and respiration were normal. The physical examination disclosed only a slight stiffness of the neck and increased muscle tone in the abdomen. The laboratory work, which consisted of a complete blood count, urinalysis, sedimentation rate,

<sup>1</sup> The laboratories of pathology, U. S. Naval Medical School, National Naval Medical Center, Bethesda, Md.

and serologic studies, showed no abnormality. Five days after admission, he showed personality changes; he was withdrawn and negativistic.

On 5 November, a lumbar puncture was performed, and the cerebrospinal fluid showed xanthochromia, 32 lymphocytes and 95 red cells per cu. mm., a protein level of 1,100 mg. per 100 cc., a decrease in the spinal fluid sugar, and a normal chloride level. The spinal fluid Kahn test and colloidal gold curve were negative. The electroencephalogram showed a generalized abnormal tracing. A diagnosis of subdural hematoma was considered, and following a neurosurgical consultation, bilateral trephine holes were made on 10 November. No subdural hematoma was found. His recovery following the operation was uneventful.

On 10 December the cerebrospinal fluid revealed xanthochromia, a continued elevated protein, and 29 lymphocytes per cu. mm. No further spinal fluid studies were performed because of the small amount of fluid obtained. The patient received symptomatic care until the middle of January, when he became incontinent of feces and urine. Despite preventive treatment he had decubitus ulcers. Weakness and frequent involuntary movements of the lower extremities occurred, followed later by progressive paralysis of all his extremities. The patient was disoriented, incooperative, and had frequent hallucinations. His temperature then showed slight elevation.

The clinical impression of meningo-encephalitis of fungal or tuberculous origin could not be substantiated. Further attempts to obtain cerebrospinal fluid were unsuccessful. All previous cultures of spinal fluid had been negative for bacteria and fungi. Throughout his illness the patient showed only transient elevations of temperature, reaching 103° F. on occasion. Starting in November, he was given 100,000 units of penicillin and, except for a few days' interruption, treatment was continued until the latter days of his illness. He received a total of 61 million units of penicillin but his condition did not improve and he died on 6 April 1949, 6 months after the appearance of initial symptoms.

#### Autopsy

**Gross examination.**—There were numerous decubitus ulcerations over pressure areas. The skin of the lower extremities was atrophic and edematous. The lungs showed mild congestion. Moderate fatty metamorphosis of the liver was present. In addition there was cystitis and moderate bilateral pyelonephritis.

The brain was normal in size and shape. The leptomeninges appeared cloudy and dull. The convolutions were slightly flattened. There was almost total absence of spinal fluid. The lumbar segment was notably enlarged and softened. The cauda equina was bound in an abundant, gelatinous, grayish exudate. The remainder of the cord, except for dull meninges, appeared normal.

Examination, after formalin fixation, showed that the choroid plexuses of the lateral ventricles were bound with a bulky, grayish, gelatinous, translucent exudate. The remainder of the ependymal lining did not appear involved. The brain substance, including the cerebellum, appeared normal. No cystic lesions were noted in either the meninges or the brain substance. Smears of the exudate in the region of the cauda equina revealed numerous, small, round to oval, single budding organisms.

**Microscopic examination.**—The meninges and the choroid plexus particularly showed extensive distortion of architecture. The entire structure contained numerous small cystlike areas containing groups of encapsulated organisms lying within giant macrophages (figs. 1, 2, and 3). The organisms were round



Figure 1.—Sections of the choroid plexus. Note the cystic lesion containing numerous organisms.



Figure 2.—Sections of the choroid plexus. Note the lack of cellular response to the organisms.

to oval, 3 $\mu$  to 20 $\mu$  in diameter, with a thick translucent capsule. The cell body stained lavender with hematoxylin and a brilliant red with periodic acid. Occasional single budding forms were present. Usually several organisms were lying free in the stroma, which was composed of a vascular fibrous tissue containing moderate numbers of lymphocytes and a few monocytes and plasma cells. In general, there was a mild cellular response to the organisms. The adjacent brain tissue showed mild inflammatory changes in the vessels. Representative sections through the cerebral cortex showed slight fibrils thickening of the meninges and a mild infiltrate of lymphocytes and plasma cells. These changes were most pronounced in the sulci. Only an occasional *C. neoformans* was noted here while the subjacent brain failed to show any. There was mild degeneration of the neurons with some spherulosis.

Spinal cord changes were most noticeable in the lumber region and about the cauda equina. The leptomeninges were no longer recognizable. The nerve trunks of the cauda were completely enmeshed in a dense exudate in which scattered organisms were distinctly outlined by their clear capsular halo. A widespread necrotizing arteritis with edema and cellular infiltration of the wall was present (fig. 4). The tissues immediately surrounding these vessels were necrotic. The neurons and nerve trunks were degenerated and the axons and perineurial spaces were swollen. The surface of the spinal cord showed sever-



Figure 3.—Details of structure of the organisms. Note the wide transparent capsule.



Figure 4.—Sections of spinal membranes. Note the necrotizing arteritis.

edema. There were scattered organisms within the wall. The other tissues showed no evidence of cryptococcal invasion.

The original colonies grew out slowly on Sabouraud's maltose agar, forming round to oval grayish yellow mucoid colonies in which no mycelia were noted. The cells were spherical, encapsulated, and measured 3 $\mu$  to 12 $\mu$  in diameter. Intracerebral inoculations of the culture into mice resulted in death; cystic lesions formed which contained myriads of organisms.

#### DISCUSSION

*C. neoformans* (*Torula histolytica*) has a world-wide distribution. It has been reported as occurring most often in the southern region of the United States. Benham (6) found cryptococci widespread in nature and in both animal and vegetable material; and very frequently found nonpathogenic forms on the skin and in the intestinal tract of normal persons.

The cryptococci are round to oval organisms, 3 $\mu$  to 20 $\mu$  in diameter, with a thick transparent capsule demonstrable in tissues or culture. They fail to produce spores or mycelia, either in tissues or culture, and reproduce by a single bud. On initial culture they grow very slowly and produce yeastlike colonies that vary from white to gray or yellow to dark brown. According to Benham the pathogenic cryptococci commonly appear shiny and mucoid. They thrive well on Sabouraud's glucose or maltose agar and subcultures grow quickly, often becoming visible within several days. They are relatively inert biochemically. Most organisms will ferment glucose to form acid, but will usually not produce gas. Intraperitoneal or intracerebral inoculation of saline suspensions of the organism into mice leads to widespread lesions from which the organism may be isolated. Death of the mice commonly occurs in 3 to 4 weeks.

#### Laboratory examination

From the laboratory standpoint, examination of the blood and urine are of little diagnostic value. The greatest aid comes from examination of the spinal fluid which is often xanthochromic and turbid, although it may be clear. The pressure is usually increased but, in our case, due to involvement of the choroid plexus, fluid production was greatly decreased. The cell count usually ranges from 200 to 800 with wide variation in the extremes and is chiefly composed of lymphocytes. The cryptococci may simulate lymphocytes and have been mistaken for them in the counting chamber. The protein is elevated in both the albumin and globulin fractions to total of over 1,000 mg. in our patient). The sugar is variable but usually low. The colloidal gold curve is usually of the meningitic type.

*Clinical features*

In the majority of the reported cases of this disease, the ages ranged from 40 to 60 years; deaths have been reported in a child of 2 and in adults over 70 years.

The disease is slightly more common in men than in women. The portal of entry is not definitely known. The most common route is believed to be via the lungs, although the organisms may enter through the skin, nasopharynx, or gastrointestinal tract. According to Levin (4) the organisms have been found in the following organs in order of decreasing frequency: central nervous system, lungs (generalized), kidney, spleen, adrenal, abdominal lymph nodes, the peribronchial lymph nodes, tonsils, subcutaneous tissues, and skin. Almost without exception death has followed involvement of the central nervous system.

The diagnosis is often difficult because (a) the disease is uncommon and not always considered in the diagnosis; (b) its manifestations are protean so that other more common conditions (the encephalitides and meningitides of tuberculosis, syphilis, other fungus disease, brain abscess or tumor, degenerative neuropathies, and psychogenic disorders) are considered; and (c) initial cultures are slow in growth so that the plate may be discarded before the organism has grown out.

Symptoms in our patient simulated psychosis, subdural hematoma, and finally meningo-encephalitis of undetermined origin. In meningeal involvement, common symptoms are headache, dizziness, vertigo, and stiffness of the neck and back. Later, a great variety of mental disturbances may appear. Physical signs commonly suggest a chronic meningitis with stiffness of the neck and back. Other signs include cranial nerve disturbances, papilledema, hyperactive and finally absent deep reflexes, and hemiplegia. Fever commonly is slight or absent, with mild, if any, elevation in pulse rate. Late in the disease, urinary tract and pulmonary infections are frequent complications. The average duration of life after onset of symptoms is from 1 to 6 months, although survival for more than 5 years has been reported.

*Differential diagnosis*

Tuberculosis and syphilis may be ruled out by appropriate laboratory and clinical examination. Neoplasms and abscesses may provide considerable difficulty. The diagnosis may have to await operation and biopsy. Subdural hematoma may provide considerable difficulty, as in this case.

The chief difficulty may be offered by other mycotic organisms. Those more commonly entering into the differential diagnosis will be

North American blastomycosis, coccidioidomycosis, actinomycosis, moniliasis, and sporotrichosis.

North American blastomycosis is characterized by suppurative and granulomatous lesions especially in the skin, lungs, and bones. In about 30 percent of the patients, central nervous system lesions occur. Like the cryptococcus, it produces a single bud from the parent cell. Unlike the cryptococcus, cultures at room temperature will form mycelia bearing numerous oval to round conidia.

Coccidioidomycosis, in its fulminant form, often ends with terminal dissemination to the central nervous system. The most reliable differentiating feature is the organism itself, which is large ( $20\mu$  to  $80\mu$  in diameter), nonbudding, spherical, and filled with numerous endospores (each  $2\mu$  to  $5\mu$  in diameter). On Sabouraud's agar at room temperature, aerial mycelial forms are produced. The branching septate hyphae segment into numerous arthrospores. Inoculation into testes of guinea pigs leads to a severe purulent orchitis from which typical organisms containing numerous endospores may be demonstrated.

Actinomycosis may affect the central nervous system but is often preceded by cervicofacial, thoracic, or abdominal suppurative and granulomatous processes that commonly form draining sinuses. In tissues typical colonies of the "ray fungus" may be seen lying in a suppurative area. Gram-negative mycelia are present in tissues and cultures. Pathogenicity may be demonstrated on intraperitoneal injection of guinea pigs.

Moniliasis may occasionally lead to a purulent meningitis with an intense polymorphonuclear and lymphocytic response. The organisms appear as small, oval, thin-walled budding bodies  $2\mu$  to  $4\mu$  in diameter. In tissues, mycelial elements may or may not be present. Corn meal agar cultures produce mycelia and the characteristic thick-walled, round chlamydospores. Rabbits injected intravenously with *Candida albicans* die in 4 to 5 days and show numerous abscesses in the kidneys.

Sporotrichosis occasionally produces fatal meningitis. There is intense cellular reaction within the meninges, with polymorphonuclear leukocytes and lymphocytes in the spinal fluid. Often the organisms are few and cannot be readily demonstrated. Injection of infected material intraperitoneally into male white rats leads to peritonitis and orchitis. Within the purulent exudate, numerous gram-positive, cigar-shaped intracellular organisms are found. Cultures on Sabouraud's agar at room temperature produce delicate, branching septate hyphae bearing conidia laterally or in groups at the ends of lateral branches.

In one hospital, trained nurse anesthetists were usually available; in the other hospital, medical officers, without previous anesthetic training, administered the anesthetic. A standard gas anesthesia apparatus was always in readiness for the administration of oxygen or inhalation anesthesia if necessary. Blood pressure and pulse were checked frequently.

With the patient in position and ready for the perineal preparation the anesthetic was begun. The solution was injected slowly, 1 or 2 cc. at a time, until the desired level of anesthesia was reached. In most cases the anesthetic was light enough to preserve uterine contractions and in many the patient continued to bear down without excitement. After delivery the patient was maintained in light surgical anesthesia if a repair was necessary. Because of the flexibility of the anesthetic agent and the rapid response it produced, the obstetrician was able to control the level of anesthesia by offering suggestions.

Table 2 shows the amount of pentothal required for multiparas and primiparas. It will be noted that most of the cases required no more than 1 gm. and that a significant number required less than 0.8 gm. Some multiparas needed as little as 0.4 gm. Only 4.6 percent of the primiparas required more than 1 gm.

TABLE 2.—*Amount of pentothal sodium required*

	Number of patients requiring—		
	Less than 0.8 gm	0.8 to 1.0 gm	More than 1.0 gm
Multiparas	38	62	4
Primiparas	32	68	2

## RESULTS

*Effectiveness of anesthesia.* Adequate depth of anesthesia was obtained in all cases. Within one-half to 1 minute after the drug was administered anesthesia was deep enough to permit delivery of the head over the perineum, episiotomy, or application of forceps. With most patients contractions continued without interruption and in many expulsive effort continued without excitement although there was effective analgesia and amnesia and between contractions the patient was asleep. It will be noted in table 1 that 60 percent of multiparous deliveries were spontaneous. This will serve as evidence that contractions and even expulsive effort continued in the majority of multiparas. In primiparas, contractions also continued in the majority of cases although only 24 percent were spontaneous deliveries because of the greater outlet resistance. This is not in accord with

the findings of Hellman et al.<sup>3</sup> and Dippel et al.<sup>4</sup> It seems to us that pentothal is not only a satisfactory anesthetic for spontaneous deliveries but that it made it easy to find and maintain light anesthesia without the excitement and attendant complications so often encountered in inhalation anesthesia.

Only 6 of 215 cases had to be supplemented with another anesthetic. Nitrous oxide and oxygen, with or without ether, was the anesthetic added. Of the 6 cases 1 was supplemented because the needle could not be kept in the vein, 1 because of laryngospasm, 2 because of shallow respirations (these latter 3 will be discussed) and 2 in order to secure uterine relaxation. Thus, the anesthetic effect was considered satisfactory in all but 6 (2.8 percent) of the series.

The attitude of the patients was invariably favorable. They frequently commented on the easy and rapid induction and were surprised to find that they awoke with little or no "hangover." Most patients awoke within 1 hour after delivery and postanesthetic vomiting was present in only a few isolated instances. These factors were especially helpful in our program of early ambulation.

*Anesthetic complications*—Difficulty was encountered in only 11 of the 215 cases and only 2 of the 11 were serious enough to be considered uncommon regardless of the anesthetic agent.

One patient had laryngospasm soon after induction before there was any stimulation of the perineum or rectum. The spasm was promptly relieved with the administration of oxygen and the introduction of an ordinary airway. Anesthesia was continued with nitrous oxide, oxygen, and ether and the delivery was completed without further event.

One patient had complete apnea for 90 seconds but began to breathe spontaneously and oxygen administered immediately relieved the cyanosis. Anesthesia was continued with gas, oxygen, and ether.

Five patients had shallow respirations but in only one of these cases was it considered necessary to resort to gas, oxygen, and ether. The remainder were carried without further difficulty when oxygen was administered.

Vomiting occurred in only two patients and neither of these aspirated. Both of these patients had vomited prior to the start of the anesthetic.

In two patients increased muscular tonus was observed and caused small tonic spasms of the extremities. This may have been caused

<sup>3</sup> HELLMAN, L. M.; SHIFFER, J. B.; MASAHAY, C. P.; and KARTHAZ, N. J.: Sodium pentothal anesthesia in obstetrics. *Am J Obst. & Gynec.*, 43: 851-860 Dec. 1944.

<sup>4</sup> DIPPEL, A. L.; HELLMAN, L. J.; WOLTER, C. E.; WALK, M. A. Jr., and HILDEBRAND, F. H.: Sodium pentothal anesthesia for selected vaginal obstetrics. *Surg. Gynec. & Obst.*, 93: 572-582 Nov. 1951.

by anoxia although in either case respirations were not impaired and no cyanosis was observed. The deliveries were completed under pentothal sodium without difficulty.

Thus anesthetic difficulty was encountered in 11 of the 215 cases (4.9 percent). Only 2 (0.93 percent) of the 215 cases, could be considered serious complications.

There were no remote anesthetic complications. No case of post-anesthetic pneumonia was encountered in this series. There were no maternal deaths.

*Fetal complications*—Condition of the babies on delivery was classified as: breathed and cried spontaneously, required mild stimulation, and required vigorous stimulation. Mild stimulation consisted of rubbing the back, aspirating the mucus, and an occasional slap on the feet. Vigorous stimulation included administration of oxygen, resuscitation by mouth to mouth breathing (no positive pressure oxygen apparatus was available) and stimulating drugs. The distribution of babies among these classifications shows that 184 (85 percent) breathed and cried spontaneously; 15 (7 percent) were sleepy and required mild stimulation; 12 (6 percent) were significantly depressed; in 4 (1.54 percent) the condition of the baby was not recorded; and 1 (0.46 percent) would not respond.

Among the babies with depressed respiration was one case thought to have intracranial hemorrhage following a difficult breech extraction with the cord wrapped about the neck three times. The child recovered completely and at 6 months was apparently normal.

Among the 216 babies (1 patient delivered twins) there were 6 fetal deaths. Two of these were macerated fetuses known to be dead prior to parturition. There were three anencephalic monsters, an unusual incidence, all of whom were born alive but died shortly after delivery. One baby could not be made to breathe although the fetal heart was heard immediately prior to delivery. Autopsy was not done but the baby appeared normal to external examination. The death could not be fully explained and therefore must be attributed to anesthetic depression. Of the 216 babies there was a gross fetal mortality of 6 (2.8 percent). The corrected mortality was 1 (0.46 percent).

#### DISCUSSION

The most common objections to the use of intravenous pentothal sodium in vaginal deliveries are the fears of respiratory depression and laryngospasm in the mother and respiratory depression of the baby. We were sufficiently impressed with these points to be wary about introducing this anesthetic in circumstances of limited equipment and personnel. Neither of these fears were materially realized

and we believe that the results presented here are an indication that intravenous pentothal sodium may be used safely in small hospitals with limited facilities provided only that certain reasonable care is employed.

The small incidence of maternal complications can hardly be explained by the fact that relatively small amounts of pentothal were used, for in those few cases where difficulty was encountered, it occurred soon after induction. Rather it appeared that occasionally a patient had some special sensitivity to the anesthetic. Later in the series we adopted the practice of starting inhalation oxygen with the induction and this practically eliminated respiratory difficulty. Stimulation of the perineum seemed to have no tendency to cause laryngospasm as is commonly thought to be the case with stimulation of the anus.

The good result with the babies must be attributed to our effort to keep the time between induction and delivery as short as possible. Although, unfortunately, no specific record of this time was kept, it usually did not exceed 10 minutes. No special effort was made to hurry delivery but rather the anesthetic was not started until all was in readiness for delivery. This is in accordance with the finding of Hellman et al.<sup>5</sup> that the concentration of pentothal in the infant's blood begins to rise appreciably after 9 minutes and soon approximates that of the mother's blood. In those cases of our series where the anesthetic was prolonged prior to delivery, the babies were visibly less alert and responsive but did not constitute a real problem.

The enthusiastic attitude of the patients to the anesthetic, because of the easy and rapid induction and the absence of undesirable after-effects, was a strong argument for us to continue its use once its safety had been established. We found that the lack of aftereffects helped induce the patients to early ambulation.

In addition to the vaginal deliveries, four cesarean sections were done under intravenous pentothal sodium with considerably less favorable results. All the babies required resuscitation and one, an 8-month premature baby, was particularly slow to respond and died several hours after delivery. The only finding on autopsy was atelectasis. The unduly depressed state of the infants might well be attributed to the larger amounts of pentothal required and the somewhat longer time elapsing from induction to delivery. From this limited experience we believed that pentothal was not a suitable anesthetic for section and, therefore, discontinued its use in such cases.

\* HELLMAN, L. M., SHETTERLY, I. R., AND STRAY, H. Quantitative method for determination of sodium pentothal in blood. *J. Biol. Chem.* 148: 293-297, May 1943.

## CONCLUSIONS

It is our belief that intravenous pentothal sodium is a safe, efficient, pleasant anesthetic for vaginal deliveries, both spontaneous and operative. We believe that it is not indicated in cases of prematurity or when prolonged difficult delivery, especially with intra-uterine manipulation, is anticipated.

## SUMMARY

Two hundred and fifteen vaginal deliveries were performed under intravenous pentothal sodium in two Army hospitals in an overseas theater; maternal anesthetic difficulty was encountered in 11 cases, only 2 of which could be considered serious. There were no remote anesthetic complications or maternal deaths; gross fetal mortality was 2.8 percent with a corrected mortality of 0.46 percent.

Eighty-five percent of all babies cried spontaneously and only 6 percent required resuscitation. The absence of undesirable after-effects in the mothers aided in a program of early ambulation.

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# Cyst of the Mandible

## Report of a Case With Prosthetic Restoration

WILLIAM T. WILLIAMS, *Colonel, DC, U. S. A.<sup>1</sup>*

**N**EOPLASTIC lesions of the mandible often present perplexing problems in surgery and prosthodontia. The oral surgeon and the prosthodontist must work in close cooperation if a satisfactory functional and cosmetic result is to be obtained. The following case report illustrates some of these problems in surgery and operative dentistry.

### CASE REPORT

On physical examination in September 1944, the patient, a 22-year-old soldier, was found to have a cyst in the right mandible. This was enucleated and he returned to duty but the lesion continued to grow and he was admitted to a general hospital on 30 September 1946 because of a recurrence of this cyst. The lesion was reported as being an eosinophilic granuloma by some and as an adamantinoma by others. The entire right side of the mandible was resected (fig 1) and later pieces of ilium were used as a bone graft. The bone grafts failed to unite in two places at first but union of the graft with the left half of the mandible was finally obtained; however, nonunion persisted in the middle of the graft. The patient was transferred to Letterman General Hospital where a piece of the left tibia was removed for an osteoperosteal graft on 3 January 1948. When the right mandible was opened a small pocket of pus was encountered and after enetting the purulent area at the site of nonunion, the wound was closed. The graft was buried in the abdominal wall. On 5 April the osteoperosteal graft was removed from the abdominal wall and found to be viable. The jaw was opened and the scar tissue was removed from the bone ends. The graft was placed in the area of nonunion and fixed with tantalum wires (fig 2).

The jaw had been immobilized by a special dental prosthetic splint, but this had to be removed because of erosion of the mucous membranes overlying the ramus of the mandible. Various methods of splinting were tried and the use of the jaw was encouraged in order to stimulate union. It was thought that the patient had enough mandible for good function if a prosthesis could be constructed to immobilize that portion of the jaw. This was accomplished.

<sup>1</sup> Letterman General Hospital, San Francisco, Calif.

# Erythema Exudativum Multiforme (Stevens-Johnson Syndrome)

G. MASON KAHN, Commander (MC) U. S. N.<sup>1</sup>

KARI M. LACKE, Lieutenant Commander (MC) U. S. N.<sup>2</sup>

HENRIET G. STOACKERIK, Lieutenant (MC) U. S. N.<sup>3</sup>

**A**LTHOUGH erythema exudativum multiforme is considered a rare entity, a review of the literature indicates that the condition is more common than previously supposed. Because the average physician is not familiar with this disease it is frequently misdiagnosed. The purpose of this review is to further familiarize physicians and students with the clinical picture and management as an aid to more accurate diagnosis and treatment.

This disease was originally described by Hebra in 1866, by Fießinger and Rendu in 1916, by Stevens and Johnson in this country in 1922, and by Baader in 1925. Various names for this condition have been used: erythema exudativum multiforme (Hebra); ectodermose erosive pluriorificelle (Fießinger); a new eruptive fever associated with stomatitis and ophthalmia (Stevens and Johnson), and dermatostomatitis (Baader). Much of the confusion in diagnosis is caused by the multiplicity of names and we believe that the original term used by Hebra is satisfactory and should be adopted.

Erythema exudativum multiforme is an acute systemic disease more common in males. The age incidence seems to be between 22 months and 19 years, although patients over this age have been reported. A group of 54 patients was studied at Duke Hospital by Noojin and Callaway (1) who stated, "It is significant that out of the fifty-four selected members not one was a Negro, although there is seen one Negro patient for every three whites at the Medical Clinics of Duke Hospital." It has long been recognized that the disease has a definite seasonal variation, occurring more commonly in the spring and fall seasons. The onset is usually abrupt and characterized by fever ranging from 102° to 106° F and lesions involving the skin, respiratory tract, and mucous membranes—chiefly those of the conjunctiva, mouth, pharynx, ure-

<sup>1</sup> U. S. Naval Hospital, San Diego, Calif.

thral meatus, and anus. These lesions vary in severity, and in rare instances cutaneous lesions are completely absent.

A distinct cause for this disease has not been proved but the consensus is that the process is a sensitivity reaction of certain persons to any one of a variety of allergens. This may include foods, drugs, and many toxic substances. Howard and Wible (2) state, "Nose and throat pathology is undoubtably a greater factor in the etiology of erythema exudativum multiforme than is generally realized." In their series of cases, it was their opinion that half could be directly attributed to sensitization by chronic infection in the tonsils and sinuses and that eradication of these foci was good prophylaxis against repeated attacks. In our series, one patient developed the disease following exposure to embalming fluid while working in a mortuary. He recovered completely and was free from symptoms until October 1948, when he returned home and again worked in a mortuary for the first time since his original attack. In another, it was believed that sulfadiazine was the sensitizing agent; and another was tattooed on the left forearm 1 week before the onset, and it was most interesting to observe that the only cutaneous manifestations in this case were bullous lesions in the area in which the red dye, apparently cinnabar, had been injected. Bacteriological studies on our cases, including throat and conjunctival smears and cultures, revealed only the usual flora of these locations. No inclusion bodies could be found on smear. This conforms with previously expressed opinions that eliminate a specific infection.

In spite of the severity of the disease, when seen in the acute phase, the prognosis regarding life is good, and death is rare. Only five fatal cases have been reported in the literature; in three of these, death was caused by bronchopneumonia (3). It should be strongly emphasized that this disease is potentially dangerous to the eye and may result in destruction of sight. Dnke-Elder (4) believed that in the milder form of erythema exudativum multiforme, the lesions of the eye may heal in a few weeks without scarring, whereas, in the more severe forms the conjunctival lesions may persist for years. In the protracted eye cases, scarring of the bulbar and palpebral conjunctiva frequently results in obliteration of the fornices with corneal opacities and ulcers.

The most important conditions to be considered in the differential diagnosis of erythema exudativum multiforme are drug eruptions, foot-and-mouth disease, pemphigus vulgaris, Vincent's angina, and chickenpox.

Drug eruptions may be difficult to distinguish. The drugs most commonly causing bullous eruptions are sulfonamide compounds, barbiturates, phenolphthalein, iodine, morgantine arsenic, and antipy-

rine. The cutaneous lesions caused by these drugs may simulate the erythema multiforme-like eruptions of the skin and mucous membranes, but are not usually as extensive or severe. Oral lesions are rare but have been known to occur. A careful history with special reference to drug ingestion will further help to differentiate the two.

The lesions of foot-and-mouth disease may resemble those of erythema exudativum multiforme, but may be differentiated by the limitation of the cutaneous lesions to the skin near the mucocutaneous junctions and to the fingers and toes. A virus may be demonstrated by guinea pig inoculation in most cases of foot-and-mouth disease.

Although pemphigus vulgaris involves the skin and mucous membranes, it is not too difficult to differentiate it from erythema exudativum multiforme. The onset of pemphigus is gradual, the course is chronic, there is an older age incidence, and tracheobronchial involvement does not occur.

Vincent's angina does not cause bullous lesions on the mucous membranes, skin lesions are absent, and stained smears from the mucous lesions reveal the typical Spirilla or fusiform organisms, or both.

The lesions of chickenpox appear in crops and are smaller than those found in erythema exudativum multiforme. The disease usually runs a mild course and the vesicles dry up in 2 or 3 days.

It has been the authors' privilege to have had under their care nine patients with erythema exudativum multiforme in the past 5 months, all of whom were severely ill and most of them had extensive mucous membrane lesions. All patients responded well to the treatment used and recovered without residual effect. Four of our patients were treated with aureomycin and they will be discussed more fully.

The treatment of this disease comprises local and general measures. In the past, in spite of varied treatment, the average patient recovered rapidly and was free of the disease within 3 or 4 weeks. Because of the severity of the oral and pharyngeal lesions, it is frequently impossible for these patients to take adequate nourishment and liquids by mouth. The general measures adopted in our cases to combat the dehydration and general toxemia included 3,000 to 4,000 cubic centimeters of intravenous fluids daily to which had been added 100 mg of thiamine chloride, 100 mg of sodium ascorbate, and 25 mg of nicotinic acid. In the rare cases with pronounced anemia, blood transfusions are indicated. Crysticillin, 300,000 units, was given intramuscularly every day to combat secondary infection. Two of our patients received sulfadiazine and sulfathiazole (0.5 gm. of each, four times daily). No objective or subjective difference was noted between the patients receiving sulfonamides and those not receiving them. One patient was given crysticillin for the first 3 days; aureomy-

ein then became available and was substituted. 1 gm. orally 3 times daily. Forty-eight hours after the institution of aureomycin the conjunctivitis had resolved by 95 percent. On the eighth hospital day there was 80 percent resolution of the lesions of the penis and on the eleventh hospital day the only lesions remaining were on the under surface of the tongue, the left corner of the mouth, and a very small crust on the foreskin. As a result of the apparent specificity of aureomycin for this condition we were encouraged to follow this form of therapy shortly afterward when three additional cases were admitted within a 48-hour period. Three days after admission aureomycin was begun in a dosage of 1 gm., three times daily. The only other therapy consisted of boric acid eyewashes, hydrogen peroxide mouthwashes, and intravenous fluids. These three patients were excellent for study purposes: one had a mild form of the condition without evidence of vesicles, although he had lesions of the mouth, nose, urethra, and foreskin; the second case was moderate in that in addition to the lesions of the mucous membranes the patient had a few scattered vesicles of the face and chest; the third patient had a severe form of the disease, his entire torso being covered with large bullae. After 8 days of aureomycin therapy we were convinced that this drug was no more effective than the penicillin and sulfonamides had been. There were no complications but the condition in no way responded more rapidly in these patients than in our earlier ones.

Our last patient was admitted following the trial with aureomycin. No therapy, other than boric acid eyewashes, hydrogen peroxide mouthwashes, and intravenous fluids, was given and this patient responded as well as any of the preceding eight.

In the treatment of local lesions strict oral hygiene must be undertaken. A cleansing mouthwash such as one-half strength hydrogen peroxide was used to free the tenacious mucus that accumulated in the mouth and pharynx. The mouth lesions were painted three times per day with 1 percent aqueous gentian violet solution. In cases of extensive involvement with laryngeal lesions and possible obstruction, facilities for emergency tracheotomy or intubation should be available. Weeping and oozing lesions of the scrotum, penis, and skin were treated with boric acid compresses and topical applications of 1 percent gentian violet. The eye lesions are most important and, because of the frequent and dangerous complications, were followed daily by the ophthalmologists. Local measures in the eye consisted of boric acid eyewashes, 30 percent sulfacetamide solution every 6 hours, penicillin ointment every 6 hours, and atropine ointment every 8 hours.

After the acute phase of the disease has subsided a thorough investigation for all foci of infection is recommended as a prophylactic measure against recurrence.

## CASE REPORT

An 18-year-old white man entered the hospital on 8 October 1948, complaining of a head and chest cold of 8 days' duration and soreness of the mouth, which began 2 days prior to admission. This illness began while travelling from Florida to San Diego. At the onset, the patient also suffered from headache, inflammation, photophobia, and lacrimation of both eyes, anorexia, and nasal congestion. Shortly after the onset, he began to have attacks of chills and fever, and pains in the chest which were aggravated by severe coughing. Dysphagia began 2 days before admission and burning on urination occurred on the morning of admission.

*Past history*.—Inquiry into the past history of the patient revealed that he had had a similar attack in 1946, at which time he received penicillin treatment and recovered in 7 days. Prior to the attack he was working in a mortuary. It may be significant to note that while the patient was on leave, just prior to his present attack, he again worked in the mortuary for 1 week.

*Physical examination*.—Physical examination revealed a well-nourished, young man with a temperature of 100.4° F., pulse 108, respiration 24, and blood pressure 135/80. He was uncomfortable, coughed frequently, and brought up copious amounts of mucopurulent, blood-tinted sputum. Vision was normal, but both bulbar and palpebral conjunctival surfaces were inflamed and drained a mucopurulent discharge. There was no involvement of the sclera. Examination of the mouth disclosed edema of the gingiva, soft palate, and uvula, many areas of inflammation and ulceration of the soft palate and gums, and a thrushlike membrane over the tongue, palate, and buccal mucosa. The lips were fissured and bleeding. Wheezes and rhonchi were heard throughout both lung fields with moist rales in the left base and right midposterior chest. There was slight inflammation of the urinary meatus with a purulent discharge. The skin at this time was normal.



Figure 1.—Bullous lesions of the penis and scrotum



Figure 2.—Vesicular and bullous lesions of the arms and chest, crusting and fissuring of the lips, and conjunctival involvement



*Figure 3.—Vesicular and bullous lesions of the upper and lower extremities.*

On 11 October the scrotum became red and began to itch. Laryngoscopy examination revealed slight swelling in the vallecular region with some difficulty in swallowing sallyn. On 12 October a few reddish papules appeared on the right side of the thorax, posteriorly. The urethral discharge had increased considerably and was purulent. The mucous membrane of the glans penis began to slough and large vesicular and bullous lesions appeared over the foreskin and skin of the penis (fig. 1). On 13 October vesicular and bullous lesions appeared on the upper and lower extremities and chest (figs. 2 and 3).

*Treatment and hospital course.*—The patient was treated with from 3,000 to 4,000 cubic centimeters of intravenous fluids daily, to which had been added 100 mg. of thiamine chloride, 100 mg. of sodium ascorbate, and 25 mg. of nicotinic acid. Crysticillin, 300,000 units and sulfadiazine, 4 gm., were given daily. All oral lesions were painted three times daily with 1 percent gentian violet, and one-half strength hydrogen peroxide was used as a mouthwash. The patient was observed carefully by the ophthalmologist for formation of adhesions of the conjunctivae and for corneal involvement. The eyes were



*Figure 4.—Erythema iris type lesions involving the chest and face and hemorrhagic crusting and fissuring of the lips.*

# Listerella Monocytogenes Meningitis

## Report of a Case

JAMES F. BERRY, Lieutenant, junior grade (MC) U. S. N. R.

LISTERELLA MONOCYTOGENES causes an infection in rabbits in which an excess of mononuclear cells in blood is a striking feature. This organism has been recovered from infectious mononucleosis in man and animals, and in meningeal infections in man. Since 1935 when Burn (1) first described a case of meningoencephalitis caused by the organism *Listerella monocytogenes*, 24 cases have been reported.

The role of this organism in man and animals has been thoroughly reported by Julianelle (2) and more recently by Kaplan (3).

Although the disease is relatively rare in man, the mortality rate ranges from 63 to 70 percent (2) (3). However, with the advent of the sulfonamides, the death rate has greatly decreased. Poiter and Hale (5) achieved good results by use of sulfanilamide and sulfapyridine in protecting mice from lethal doses of *Listerella*.

Foley, Epstein, and Lee (4) found that each of their 7 strains of *Listerella* grew freely in 40 times the concentration of penicillin necessary to completely inhibit the growth of other gram-positive organisms. They therefore assumed that *Listerella* was penicillin-resistant.

In spite of these reports, the strain of *Listerella* recovered in the case reported here was found to be more sensitive to penicillin *in vitro* than to either sulfadiazine or streptomycin.

### CASE REPORT

On 19 May 1949 a 32 year-old white man was admitted to a naval hospital complaining of a severe headache of 14 hours duration. On admission he was delirious.

According to his wife, he was apparently well the day prior to admission and he had worked the entire day at his job as a metal die caster. After a large dinner he took a nap for about 1 hour. When he awoke he complained of a slight headache and went to bed.

At 2300 the patient was restless and his temperature was 104° F. A physician gave him an injection of penicillin and he was hospitalized.

The past and family histories were noncontributory.

Physical examination revealed an acutely and seriously ill man. The temperature was 104° F.; pulse, 80; respirations, 20; and blood pressure, 154/84. The neck was stiff, and Kernig's sign was positive, while Brudzinski's sign was negative. The general physical examination was otherwise essentially normal. Complete neurological examination (as far as the cooperation of the patient permitted) was normal except for a positive Babinski reflex on the left.

A spinal puncture, performed soon after admission, showed a pressure of 340 mm. water. The pressure was slowly reduced to 200 mm. water. The spinal fluid was slightly turbid and smears revealed many small gram-positive rods.

Thirty minutes following the spinal puncture the patient's sensorium cleared considerably and the headache was definitely relieved. Fourteen hours after admission severe headache accompanied by delirium returned and a spinal puncture was again performed. At this time the spinal fluid pressure was 520 mm. water, and the fluid was definitely cloudy. The pressure was again reduced to 200 mm. water with immediate relief of symptoms; the blood pressure, which had risen to 180/120 prior to the second spinal puncture, returned to normal.

One more therapeutic spinal puncture was necessary to relieve the headache the following day, 38 hours after admission. The spinal fluid pressure at this time was 190 mm. water, and the fluid was still cloudy.

A 48-hour culture of the spinal fluid showed small gram-positive rods in pure culture. Blood cultures taken on admission were negative. On the third hospital day a specific diagnosis of *Listeria monocytogenes* meningitis was made.

During the next 7 days, repeat spinal punctures were performed for penicillin, sulfadiazine, and streptomycin levels as well as spinal fluid chemistry. Throughout this period, the temperature was returning to normal by lysis and the patient was relatively asymptomatic. On the ninth day of hospitalization the patient had a generalized, follicular, morbilliform type of skin eruption, which responded promptly to antihistamine drugs and the discontinuation of sulfadiazine and streptomycin. (*In vitro* studies were now available showing the organism more sensitive to penicillin than to either sulfadiazine or streptomycin.)

The remainder of the hospital course was unremarkable. Penicillin was gradually decreased, and discontinued at the time of discharge on 11 June 1949, 23 days after admission.

Follow-up studies at monthly intervals have failed to reveal any abnormalities in the electrocardiogram, blood, urine, or spinal fluid.

#### *Laboratory findings*

Complete red and white blood cell counts after 20 May 1949 were within normal limits. The results of the Davidssohn test, blood Kuhn test, and the test for cold agglutinins were within normal limits.

#### BACTERIOLOGY

The organisms were small gram-positive rods, approximately  $0.5\mu$  in breadth and  $1$  to  $2\mu$  in length. They were nonecapsulated, and non-spore-bearing. They

# The Retromolar Area

## Its Significance in Full and Partial Denture Construction

AUGUST BARTELLE, Commander (DC) U. S. N.<sup>1</sup>

THE pear-shaped pad of tissue lying distally from the position of the mandibular third molar and formed by the external and internal oblique lines has been known variously as the retromolar area, retromolar triangle, retromolar papilla, or retromolar pad. The importance of this pad of tissue with its underlying structures and its relation to full and partial denture construction has frequently been overlooked. The failure to include this pad of tissue in the mandibular impression, or cutting the resulting impression of this pad from the distal extension of the finished mandibular full or partial denture, will result in early destruction of the mandibular alveolar ridge. This destruction is accompanied by loss of retention, stability, centric relation, vertical dimension, and comfort.

The retromolar pad consists principally of loose connective tissue, within which are located the retromolar mucous glands (1). Below the pad are the terminal fibers of the temporal muscle which forms part of the retromolar area (2), the pterygomandibular raphe, and that part of the buccinator muscle which arises from the raphe (3). Below these structures is the thick periosteum covering the floor of the retromolar fossa (1). The bone is of the cortical type, forming a thick band distally from the third molar alveolus. It is functionally active in furnishing attachment for muscles and is, therefore, a relatively stable bone (4).

The soft character of the mucosa with the resilient character of the fibrous attachments in the submucosa make this pad of tissue ideal for post dam. This post dam is important in mandibular full denture retention. The dense bone below these structures affords support for the mandibular full or partial denture and resists the forces of mastication.

Anteriorly to the retromolar area, the crest of the residual alveolar ridge is covered with dense fibrous connective tissue (5). Below this

<sup>1</sup> U. S. Naval Dental Clinic Pearl Harbor, T. H.

is a thin layer of cortical bone and varying amounts of spongy bone where atrophic changes are common (1). The character of the tissue and bone anterior to the retromolar area predisposes to failure of the denture if terminated in this area (fig. 1). Four cases are presented where the partial or full denture failed because it terminated anteriorly to the retromolar pad.

Some factors, such as clasp design, that may contribute to the failure of the partial denture are shown in the illustrations. These factors will not be discussed in this article.

#### CASE REPORTS

**Case 1.**—The patient had been wearing a maxillary full denture and a mandibular lingual bar partial denture for about a year. His chief complaint was that his anterior alveolar ridge was sore and that he could not masticate his food properly.

Examination revealed an inflamed mucosa under the denture in the maxillary central and lateral incisor area. There was loss of occlusion in the molar area and a  $\frac{1}{2}$ -mm space between the teeth. The saddles of the mandibular partial denture did not include the retromolar area. The mandibular alveolar ridge in the molar region revealed apparent absorption of the supporting bone.

Failure to include the retromolar area in the saddles of the mandibular partial denture (fig. 2) had caused the forces of occlusion to absorb the alveolar bone.



Figure 2.—Case 1. Mandibular partial denture with saddles short of the retromolar area.

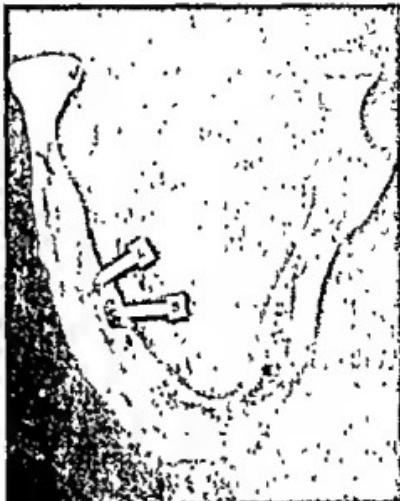


Figure 1.—At A (retromolar area) bone is of the dense cortical type. Partial and full dentures should terminate here. At B, bone is of the thin cortical and spongy type. Atrophic changes are common under stress if the denture is terminated here.

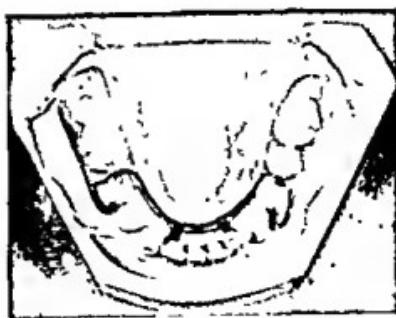


Figure 3.—Case 2. Mandibular partial denture with saddles short of the retromolar area.

resulting in a loss of vertical dimension and discomfort in the anterior maxillary region.

A redesigned partial denture was constructed with extension of the saddles into the retromolar area with correct centric and vertical dimension.

*Case 2.*—The patient had been wearing a mandibular lingual bar partial denture for 3 months.

His chief complaint was that his mouth was sore, and that excessive amounts of food got under the partial denture. He had had several adjustments during the 3-month period, but did not obtain relief.

Examination revealed the teeth in the partial denture set up in cross bite relation. The tissue-bearing area of the saddles was small and appeared to be far less than the patient could tolerate. The retromolar area was not included in the saddle (fig. 3).

The partial denture was ill-fitting because of cross bite and inadequate saddles.

A new partial denture was constructed which corrected the cross bite, extended the saddles into the retromolar area, and which enlarged the tissue bearing area to the tolerable limits of the muscle attachments. This new partial denture has now been worn 26 months with the masticatory function satisfactorily restored.



Figure 4.—Case 3. Partial denture in place on stone cast.



Figure 5.—Case 3. Dark lines indicate retromolar area. Broken lines indicate denture area where extensive destruction of the alveolar ridge was apparent.

*Case 3.*—The patient was wearing a maxillary full denture and a mandibular lingual bar partial denture. While removing the denture, he accidentally severed a blood vessel in the floor of the mouth with one of the clamps. He was referred to the Prosthetic Department for a new prosthetic appliance.

Examination of the mandibular alveolar ridge revealed extensive destruction of the supporting bone. The retromolar area had not been included in the denture area (figs. 4 and 5). There was definite loss in vertical dimension and centric relation.

A new maxillary full denture and a new mandibular partial denture extending the saddles into the retromolar area was constructed.

*Case 4.*—The patient was wearing full maxillary and mandibular dentures. He stated that his mandibular denture was "very loose." About 1 month previously he had had both maxillary and mandibular dentures relased to improve their retention.

Examination revealed that the maxillary denture was satisfactory. The mandibular denture had no retention; the tissue-bearing area in the posterior of the right and left sides was inadequate, and did not include the retromolar area (fig. 6). The vertical dimension and centric relation were satisfactory.

The mandibular denture was rebased, extending the tissue-bearing area to the tolerable limits of the muscle attachments and over the retromolar area. This denture has been worn satisfactorily for a year.



*Figure 6.—Case 4. Mandibular full denture with saddles short of the retromolar area.*

#### SUMMARY

Four cases are presented in which partial or full dentures failed. In the cases presented, the dentures failed in the loss of retention, stability, centric relation, vertical dimension, and comfort because the retromolar area was not included in the denture area. The importance of the retromolar area in full and partial denture construction should not be overlooked.

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# The Hanger Cephalin Cholesterol Flocculation Test and the MacLAGAN Thymol Turbidity Test

## Correlation With Autopsy Findings

ARTHUR L. LAWLER, Commander (MC) U.S.N.<sup>1</sup>

ROBERT R. HIRSH, Lieutenant, junior grade (MC) U.S.N.<sup>1</sup>

THE cephalin cholesterol flocculation and the thymol turbidity tests have many clinical advantages in determining the extent of liver damage and the differentiation of its various forms. Actually these reactions do not test any known function of the liver and should more properly be regarded as indicators of disturbed liver metabolism rather than as specific liver function tests (1).

The more recently described reaction, the thymol turbidity test, was first reported in 1944 by MacLAGAN (2) when "in the course of work on the serum colloidal gold reaction it was noted that the thymol which was used to inhibit the growth of mold in the barbitone buffer produced a marked turbidity or precipitate with certain sera, usually those from patients who had parenchymatous liver disease." Making use of these observations, he devised the thymol turbidity test as "an indicator of liver dysfunction." In a series of clinical cases he determined that this test was about 91 percent reliable in infectious hepatitis and about 52 percent reliable in Wed's disease.

At first it was supposed that the underlying mechanism of these two tests was the same. However, as more clinical cases were studied, many instances were found in which these tests were not at all in agreement or in which they agreed in only certain stages of the disease (3). The variation in different stages of the same disease is perhaps best illustrated in infectious hepatitis where the cephalin cholesterol flocculation test becomes abnormal first and the thymol turbidity test remains positive long after the cephalin cholesterol flocculation test has returned to normal (4).

<sup>1</sup>The Hektoen Institute for Medical Research, Cook County Hospital, Chicago, Ill.

The degree of elevation of the thymol turbidity test appears to be directly proportional to the degree of lipemia present, and the extraction of all lipids from a positive sera prevents the reaction which can again be made positive by the addition of lipids from a normal serum. Thus, it is believed that in the thymol turbidity test the gamma globulin determines whether the reaction will be normal or abnormal, while the lipemia present determines the elevation of the test. This perhaps explains why no correlation has been found between the severity of symptoms and the degree of elevation of the thymol turbidity test (7).

Also, unlike the cephalin cholesterol flocculation test, it has been noted that the thymol turbidity test decreased in liver disease following the intravenous administration of large amounts of concentrated serum albumin over a period of days (7). This has been confirmed in various laboratories where an elevation of the serum albumin decreased the thymol turbidity reaction (4).

Some of the advantages claimed for the thymol turbidity test are as follows:

- (a) An easier reagent to prepare with weighed amounts of chemicals which do not require aging.
- (b) A more stable and less photosensitive agent than the cephalin cholesterol.
- (c) A satisfactory test that can be performed on sera after several weeks' refrigeration.
- (d) The results on nonfasting specimens are slightly higher than on fasting specimens but less in error than the cephalin cholesterol flocculation test.
- (e) An accurate and reproducible result free from subjective estimation and error.
- (f) A rapid determination; completed in  $\frac{1}{2}$  hour instead of 48 hours.
- (g) Fewer false positive reactions.

(h) Appears to be more often normal in uncomplicated obstructive jaundice than the cephalin cholesterol flocculation test.

(i) A test of definitely more diagnostic value in following convalescent cases of infectious hepatitis.

(j) A test that is easily checked since it is normally elevated in dogs and rabbits.

The emphasis placed upon these 2 tests of liver dysfunction is apparent in the more than 200 articles published in the past 10 years. The clinical and biochemical aspects have been and are being extensively investigated.

The authors of this article believed that a correlation of these tests should be attempted in which not the clinical but the autopsy diagnoses are used. The purpose of this article is to present such a correlation.

Case records and autopsy findings at the Cook County Hospital during 1947 and 1948 were reviewed. Of these, 100 cases were found in which pathologic change was noted in the liver and in which cephalin cholesterol flocculation and thymol turbidity tests had been done. In 91 cases, a total protein determination with A/G ratios was also available. The liver disease was not necessarily the cause of death nor the primary disease of the patient and in no case was death due to cholemia.

The average age of the patients was 57 years. The average time interval between performance of these tests and death was 14 days. In four cases, the thymol turbidity test had been elevated previously and was normal just prior to death, while in two cases, the same occurred with the cephalin cholesterol flocculation test. For the purpose of this report, only the last determination prior to death is used.

The cephalin cholesterol flocculation test was performed by the technique of Hanger (8) as modified by Neefe and Reinhold (9). A flocculation of more than 2+ in 48 hours was considered abnormal.

The thymol turbidity test was performed in accordance with the technique recommended by MacLagan (1). A turbidity of over 4 units was considered abnormal. The thymol flocculation test, as suggested by Neefe and Reinhold, was not recorded.

The serum total proteins, albumin and globulin concentrations were determined after the photoelectric method of Kingsley (10). The normal range of total serum proteins was taken as 6.5 to 8.0 gm. per 100 cc.; the albumin as 4.0 to 5.5 gm. per 100 cc.; the globulin as 1.5 to 3.4 gm. per 100 cc.

Of these 100 cases, 122 distinct pathologic diagnoses were determined on gross and microscopic examination of the livers. These diagnoses were divided into 12 groups (table 1).

TABLE 1.—*Distribution of the abnormal cephalin cholesterol flocculation and thymol turbidity tests by groups*

Groups	Abnormal CCF <sup>1</sup> only	Abnormal TT <sup>2</sup> only	Both tests abnormal	Neither abnormal	Total cases
Cirrhosis with jaundice	1	9	14	5	29
Cirrhosis without jaundice	0	0	0	1	1
Congested liver	0	0	0	14	14
Fatty liver	1	10	7	0	17
	0	2	2	1	1
	1	5	5	0	1
	3	4	6	0	12
	0	3	1	1	1
Malignant biliary obstruction with infection	0	2	0	0	2
Malignant biliary obstruction without infection	1	4	3	0	8
Miscellaneous	0	4	0	2	6
Total	7	44	34	37	123

<sup>1</sup> Cephalin cholesterol flocculation.<sup>2</sup> Thymol turbidity.

The groups were arranged to include cases with a variety of specific lesions in which similar liver damage was found at autopsy. Table 2 lists the percentage efficacy of these tests by groups.

TABLE 2.—*The percentage efficacy of the cephalin cholesterol flocculation and thymol turbidity tests alone and together by groups*

Groups	Number of cases	Percentage efficacy of the CCF <sup>1</sup>	Percentage efficacy of the TT <sup>2</sup>	Percentage efficacy of both tests
Cirrhosis with jaundice	29	51.7	79.3	82.7
Cirrhosis without jaundice	1	0	0	0
Congested liver	10	0	0	0
Fatty liver	15	23	92.3	100
	5	0	80	60
	16	37.5	62.5	68.7
	12	75	25	100
	5	0	80	80
	2	0	100	100
	8	12.5	87.5	100
	6	0	16.6	66.6
	6	0	50	50
Average percent efficacy	...	27.9	63.9	69.6

<sup>1</sup> Cephalin cholesterol flocculation.<sup>2</sup> Thymol turbidity.

## DISCUSSION

The first group is made up of 29 cases of Laennec's type cirrhosis with jaundice as a result of this disease. No cases of biliary cirrhosis were included in this group, these having been listed under the appropriate causes of obstruction. Since only about 20 percent of the cases of Laennec's cirrhosis might be expected to develop jaundice and this usually as a preterminal or terminal event, we would anticipate finding distinct pathologic changes in these livers. This was true in all 29 cases. However, in 5 of these cases both tests were

entirely normal, and in only 14 cases were both tests abnormal. If only one test was abnormal it was more likely to be the thymol turbidity by a ratio of 9:1. This same ratio has been reported elsewhere in cases of cirrhosis (11). MacLagan originally reported 13 abnormal thymol turbidity tests in 13 cases of cirrhosis while Stillerman (11) reported 96 percent reliability of the thymol turbidity test in 48 cases of clinical cirrhosis. Most of the reports in the literature, however, have indicated a percentage reliability of about 70 percent (3) (12). As can be seen in table 2, the percentage reliability of the thymol turbidity test in our 29 cases of cirrhosis with jaundice was 79.3 percent while the cephalin cholesterol flocculation test was 51.7 percent reliable. Using both tests, one or the other, or both indicated liver disease in 82.7 percent of the cases. Theoretically, we would expect to find a high percentage of reliability of the thymol turbidity test in cirrhosis since all the factors which tend to elevate this test are present. That is, a high gamma globulin, a high lipid, and a low albumin level in the blood (4). The explanation of this discrepancy must await further studies on the basic mechanism of this test.

The second group included only one case of cirrhosis without jaundice in which neither test was abnormal.

In the third group were 19 cases of congestion of the liver. These included chronic passive congestion, and congestion occurring in the terminal state. The gross and microscopic findings in the liver were similar to those found in congestive heart failure, although in only one case was this the cause of death. Positive thymol turbidity values have been reported in from 30 to 55 percent of patients suffering from various types of heart disease (11) (13). That this was not simply the result of congestion of the liver was pointed out when it was noted that the presence or absence of circulatory failure did not appear to influence the results of these tests (11). Similarly, in our 19 cases, simple congestion of the liver did not cause either test to be abnormal.

Thirteen cases were diagnosed as fatty infiltration of the liver. This is a stage through which a number of parenchymatous diseases of

twentieth days (12) of illness, at which time the blood lipid level is also high (4) and at which time some fatty infiltration may first be seen in liver biopsies. Our findings in 13 cases of fatty infiltration also showed a high percentage of reliability for the thymol turbidity test (92.3 percent) while the cephalin cholesterol flocculation test which is less affected by blood lipids was only 23 percent reliable in

Of the 16 cases with metastatic carcinoma of the liver without biliary obstruction, both tests were abnormal in 5, neither test was abnormal in 5, an abnormal thymol turbidity test only was noted in 5, and in 1 case the cephalin test alone was abnormal. Kunkel, working with clinical material, found a number of cases with metastatic neoplasm in the liver which showed abnormal thymol turbidity values and normal cephalin cholesterol flocculation tests. Here again, the abnormal values could not be correlated with the extent of parenchymal destruction.

Toxic hepatitis, more frequently caused by toxicity associated with disease other than that due to drugs or poisons, was evident in 12 cases at autopsy. In three cases the thymol turbidity test alone was abnormal, in three cases the cephalin test alone was abnormal, while in six cases both tests were abnormal. Thus each test was 75 percent reliable and together they indicated disease in all 12 cases. Popper and Franklin (14) in studying 21 clinical cases of toxic hepatitis with biopsy specimens, found that most of these cases had abnormal values for the thymol and cephalin tests but found that in a number of cases both tests were normal when considerable damage was indicated by the biopsies and other laboratory tests. Evidence suggests that many acute infectious diseases have an associated toxic hepatitis, for some investigators have reported that as many as 37.5 percent of patients with acute infections have abnormal thymol turbidity tests which return to normal during convalescence (11).

Five cases were classified as benign biliary obstruction with infection, and two cases as benign biliary obstruction without infection. In neither group was the cephalin test alone abnormal, while the thymol turbidity test was 80 percent reliable in the presence of infection and 100 percent reliable without infection of the biliary tract. From the literature it might be expected that both tests would be more reliable in the cases of obstruction with infection but our groups here

are quite small and perhaps with a greater number of cases this would be true. The poor correlation of the extent of disease with the cephalin cholesterol flocculation test, and good correlation with the thymol turbidity test, has been observed elsewhere in cases of biliary obstruction (7).

Of the 14 cases with malignant biliary obstruction, 8 had associated infection of the biliary tract and 6 were without infection. An abnormal cephalin test alone was noted in only 1 of these 14 cases while in 3 cases with infection both the cephalin and thymol turbidity test were positive. In considering all 21 cases of biliary obstruction together we do find that the thymol turbidity test is about 10 percent more reliable in the presence of infection. Popper and Franklin reported 73 cases of biliary obstruction, 33 of which were due to cancer and 40 were of benign origin. They also noted that most of their cases showed normal cephalin tests while the thymol turbidity test was slightly elevated.

The miscellaneous group included one case of multiple myeloma in which the total proteins were 10.4 gm per 100 cc. of which 9.2 gm. was globulin. This patient had a normal thymol and cephalin test 1 day prior to death. At autopsy the liver was large and the seat of myelomatous and moderate fatty infiltration. The second case was that of miliary tuberculosis with diffusely scattered tubercles throughout the liver. Here again, both tests were normal. A third case was found to be Hodgkin's disease in which the liver was enlarged and showed a diffuse infiltration of the lymphomatous process.

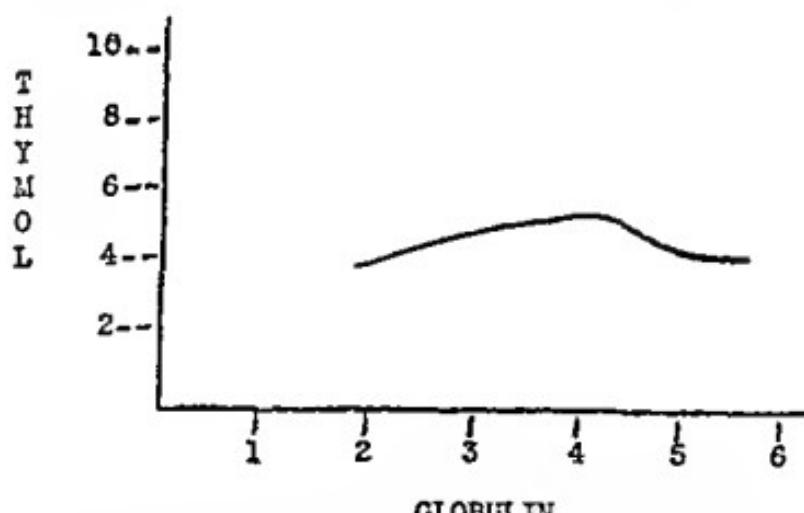


Figure 1—A mean distribution curve of 91 cases with the mean thymol turbidity value in MacMahan units plotted against the globulin level in the blood in gm per 100 cc.

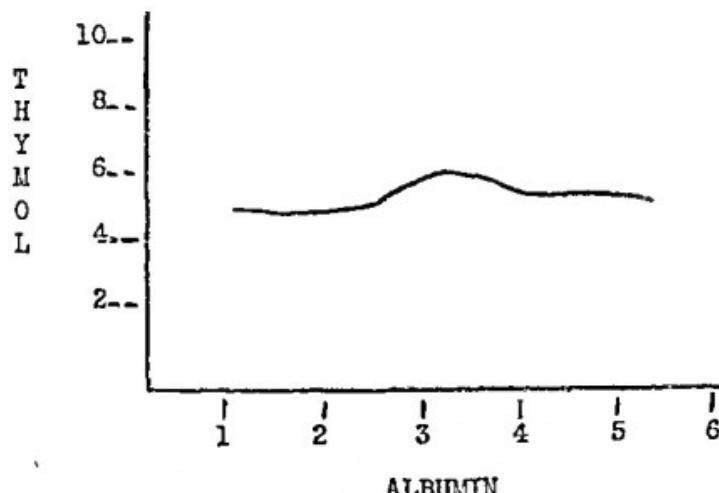


Figure 2.—A mean distribution curve of 91 cases with the mean thymol turbidity values in Maclagan units plotted against the albumin level in the blood in gm. per 100 cc.

In this case the thymol turbidity was 16.8 units and the cephalin test was 4+ in 48 hours. A case of pernicious anemia had an abnormal thymol and normal cephalin test. At autopsy, the liver was found to have a central necrosis of all lobules. One case diagnosed as a reticulum cell carcinoma of the lymphoid tissues had an abnormal thymol and normal cephalin test. The liver was diffusely infiltrated by the carcinomatous disease. The last case was one of nutritional anemia in which both tests were normal. At autopsy, generalized moderate atrophy of the liver cords was noted with an over-all brownish pigmentation and no evidence of regeneration. To determine what relation the thymol turbidity in Maclagan units might have to the globulin level in the blood, a mean distribution curve was prepared (fig. 1). Ernst and Dotti (12) found a mean deviation of 1.8 in 522 thymol turbidity values on 500 supposedly normal individuals. While in those suffering from disease not considered to involve the liver, a mean deviation of 2.7 was found in 538 tests on 527 hospitalized patients. Figure 1 has a deviation of less than these observers found in normal subjects and we can conclude that the thymol turbidity test, in units, bears no relation to the total globulin level of the blood. Similarly, when a mean distribution curve is prepared using the albumin level in the blood, no significant deviation is apparent (fig. 2). While therapeutically elevating the albumin level may lower the thymol turbidity reading in an individual case, the initial thymol reading does not appear to be significantly related to the initial albumin level of the blood.

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# Anterior Fixed Bridges

A Technique for Construction by Means of One-Piece Casting

JOHN A. PARKER, Lieutenant Commander (DC) U. S. N.<sup>1</sup>

THE paucity of literature available on construction of anterior fixed bridges by means of one-piece castings leads to the belief that this method is not in common use. Should this premise be correct, it is regrettable, for bridges constructed by the technic described here have been found to be stronger, easier to seat, and therefore subject the teeth to less torque; in addition, it effects a saving in chair and laboratory time. It is necessary to have only two sittings: the preparations and impressions are made at the first sitting and the completed bridge is inserted at the second.

A detailed discussion of the preparation of the abutment teeth to receive the three-quarter crowns will not be given. However, the preparations must be precise and all surfaces should be made as smooth as possible with sandpaper disks and fine finishing stones. The importance of cutting parallel grooves cannot be overemphasized. The mesial grooves of the abutment teeth must be cut parallel to each other and the distal grooves cut parallel to the mesial. To accomplish this a long-pointed Boley millimeter gage is used; the points are coated with carbon or indelible pencil and the mesial surfaces of both abutment teeth are marked. The mesial grooves are cut and, when completed, the positions of the distal grooves are marked in the same manner, using the mesial grooves as a guide. It follows then that all four grooves must be parallel. This is important in the construction of anterior fixed bridges by any method but is mandatory when using the one-piece casting technic.

A number of impression materials<sup>2</sup> may be used with good results but their preparation for use is not as simple as with some elastic im-

<sup>1</sup> Dental Department, U. S. Naval Recruting Station, U. S. Naval Station, San Diego, Calif.

<sup>2</sup> The material used should not have to be soaked in hardening solution as the change in dimension, after soaking for 15 minutes, is deleterious to the finished model.

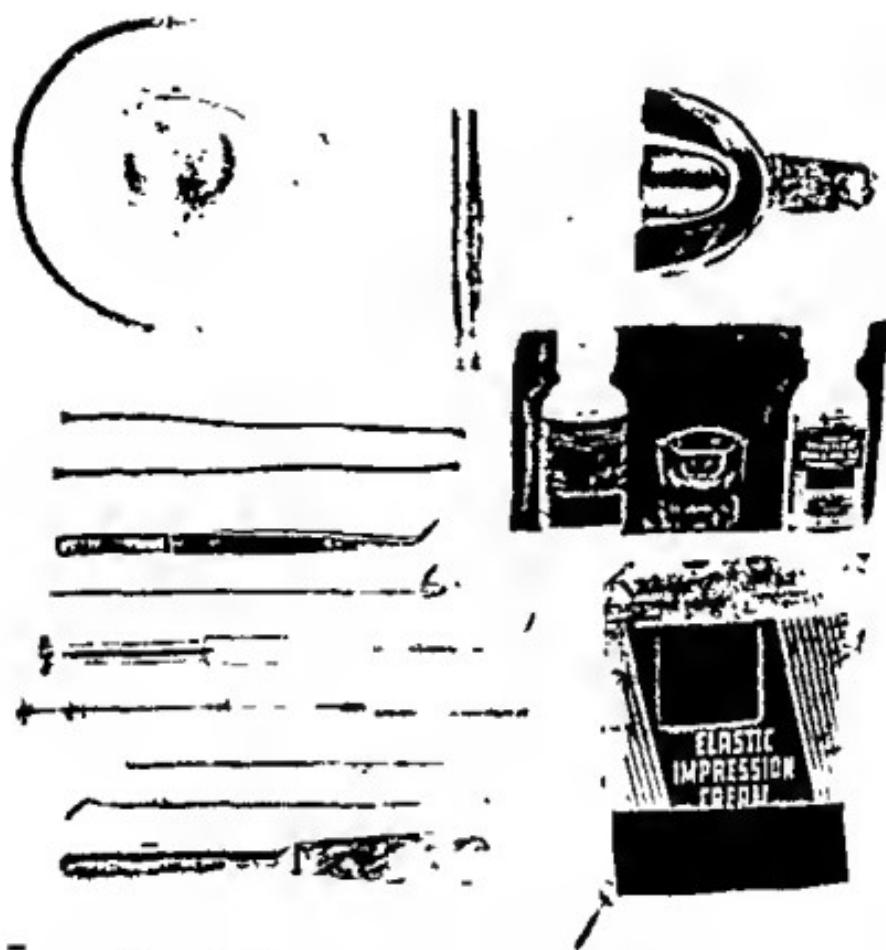


Figure 1.—Equipment required for making impressions.

pression creams. The equipment required for the latter is a rubber bowl, a plaster spatula, cement spatula, a 5-cc. glass or metal syringe and a shortened 18-gage needle (fig. 1).

Prior to taking the impression, the gingival tissue must be pushed back 2 or 3 mm. from the finish line of the preparation. This is accomplished by inserting a piece of string saturated with an astringent (dental glycerite on the Supply Table or a 20-percent solution of zinc chloride) under the free margin of the gingival tissue; the diameter of the string used is comparable to that of a 14-gage wire. The initial insertion of the string is made at a point on the labial surface a few millimeters anterior to the mesial labial wall of the preparation and is gently pushed in place under the mesial, lingual, and distal gingiva with an instrument such as Woodson's No. 2 plastic. Indue trauma must be avoided for it will tear the tissue from its attachment





Figure 3.

When setting of the stone model is complete, it is separated and trimmed to remove all surplus material. That part of the model that represents the overhanging free margin of the gingival tissue is carefully removed to permit free access to the finish line of the three-quarter crown preparations of the abutment teeth. At this point the model is further trimmed to receive the necks of previously selected facings and the facings are tentatively arranged in the space to be bridged although no attempt is made to grind them in. The stone

an ice water bath that covers approximately 1 inch of its base and is permitted to chill for 30 minutes. The stone model is next carefully removed and another model is poured, using cristobalite model investment. Upon separation the stone and cristobalite models should be carefully examined to insure that exact duplication has been attained.

To permit free access to the distal surfaces of the abutment teeth for the purpose of contouring the wax three-quarter crowns and for establishing contact points, it is necessary to split the cristobalite model into three sections. This is accomplished by first trimming and beveling the base of the model and scouring its under surface. The



erythrocytes have been tried in this study, many more remain to be examined. The view previously expressed (1) on the possibilities for bringing into the light other positive hemagglutinations is, therefore, still being held.

The results recently reported by others on the agglutination of sheep cells by Japanese encephalitis and by Lansing viruses could be shown to be brought about not by the virus, but by the mouse-brain tissue, as such, present in the virus suspension. Verlinde and de Baan (5) have also stated that uncentrifuged normal mouse brains, even greatly diluted, agglutinate sheep cells. Attention is drawn to the fact brought out here and supplemented by the experiments reported in an earlier article (1) that the technique of hemagglutination by neurotropic viruses as contained in mouse-brain suspensions should be carefully controlled with respect to its variables to avoid confusion with nonspecific, nonviral agglutinations. One of the variable factors that appears to be significant is the degree of clarification of the viral suspension, since the degree of nonspecific reaction has been shown to be apparently correlated with the relative intensity of clarification of such suspensions obtained by means of centrifugation.

## CONCLUSIONS

- bits, as the Coxs from 25 indicate that normal mouse brain in suspension may give false positive agglutinations.

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to 4 months (average 3 days) after the onset of symptoms. The pain was in no way related to the taking of food.

TABLE 1.—*Admitting diagnosis of 31 patients with ancylostomiasis*

Appendicitis.....	10	Dysentery.....	1
Original correct diagnosis (ancylostomiasis).....	10	Intestinal obstruction.....	1
Gastro-enteritis.....	2	Tumor of sigmoid.....	1
Peptic ulcer.....	2	Perforated peptic ulcer.....	1
Food poisoning.....	1	Cholecystitis.....	1
		No abdominal pain.....	1

TABLE 2.—*Location of pain in 30 patients with ancylostomiasis*

Epigastrium.....	9	Left lower abdominal quadrant.....	4
Right lower abdominal quadrant.....	8	Periumbilical.....	2
Right upper abdominal quadrant.....	6	Generalized.....	1

#### CASE REPORTS

**Case 1.**—A 47-year-old laborer was admitted at 1300 complaining of a severe epigastric pain that came on suddenly after drinking a glass of water 4½ hours earlier. The pain was lancinating, localized, and accompanied by nausea. He had had periodic attacks of a similar but milder pain in the past several years. His conjunctivas and mucous membranes were pale. There was tenderness and cramping in the epigastrium and right upper abdominal quadrant. His temperature was 101.4° F., pulse rate, 100, and respiratory rate 22. The erythrocyte count was 3,610,000 with 70 percent hemoglobin. The leukocyte count was 10,200 with 2 percent eosinophils. A Levin tube was placed in the stomach and attached to a suction apparatus. The patient was given intravenous fluids. Serum amylase was 30. Within 8 hours all symptoms and signs had disappeared completely and the temperature was normal. Hookworms were found in the stools and were eliminated by appropriate treatment.

**Case 2.**—A 33 year-old chauffeur was admitted with a history of gradually increasing cramping pain of 1 week's duration in the right lower abdominal quadrant and right flank. In the past 2 years he had had two attacks of a similar, but less severe pain. Although the present attack was unaccompanied by nausea or vomiting, the patient noted that his stools were softer than normal. A mild burning on urination had been noted several times in the immediate past. On physical examination, superficial and deep tenderness in the mid-abdominal region was noted. Slight tenderness was present in the right costovertebral angle. The erythrocyte count was 3,702,000 with 75 percent hemoglobin; leukocyte count was normal, but repeated differential counts showed 5 or 6 percent eosinophils. Two successive stool examinations disclosed hookworms. The patient was treated and discharged cured.

#### COMMENT

These patients have presented a difficult problem in diagnosis; we have to recognize them largely by the varied clinical findings. The symptoms and signs do not follow the general pattern of events seen in acute conditions within the abdomen. Most of these patients have been undernourished and have shown evidence of anemia. We

treat them expectantly and observe them closely. The signs and symptoms usually improve promptly and stool examination confirms a diagnosis of hookworm. We have been aided by a staff of trained technicians who give us prompt and accurate reports of stool examinations. In this group of patients, none of whom were operated on, close observation and study prevented needless operations.

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Many, whose motives are purely selfish, or at least show little evidence of higher ideals, will accept service willingly enough merely because of their liking for certain phases of it. Some accept it as a means of escape from an unsatisfactory environment. Others accept it because there is no other way out.

The incentive to serve well can be killed even in men with the finest motivations, through bad handling and disillusioning experiences. At all stages in the soldier's career the desire to serve must be fostered. It is stupid to promote enthusiasm by sentimental exhortation and promises and then kill it in the early days of service. First impressions of service life are apt to be the most lasting. Introduction to hard training should be gradual rather than a sudden application of discipline that is so often practiced. Never is intelligent leadership more significant than in the early stages of training. Once a man can see the reasons for regulations and has the feeling that he is being fairly dealt with, he usually adapts himself quickly to the needs of the group. Thereafter, if he can realize that the inherent strength of the group is greater than his own he is well on the way to becoming a good soldier. If, however, he conceives that he is an outcast or misfit, unfairly disciplined, or so badly treated that he becomes resentful, or is made to obey through fear alone, then his future usefulness to the Armed Forces will not be hard to predict. Unless he is "mentally rescued" by an improvement in man management or individual psychiatric attention he soon will become motivated to escape rather than to serve. In time, unless conditions are corrected, or even in spite of correction, he will, in all likelihood, either attempt to "work his ticket" out of the service through some form of dissimulation, become a chronic offender, or show neurotic behavior or evidence of a psychosomatic disorder.

Of course, mental or psychic breakdown can occur at any stage of training or operations, but it is believed that the most critical period is during the early stages of adjustment to the service. Emotional conflicts set up and not resolved at this stage, probably account for many of the disturbances that appear later when exposed to additional stress. There are those who still believe that early selection should eliminate all those with any neurotic behavior patterns (if it were really practicable to do so) and thenceforth they assume that neurosis will not occur. Certainly the experiences of the last war do not seem to bear out their contentions. Unselected men appeared to show no higher breakdown rate than those who were selected. Unfortunately there is no means of now knowing how well those who were turned down at examination would have done had they been accepted.

If we can then assume that the early period of transition from civil life to service environment is as important to the production of good

soldiers as is believed, let us consider some general principles in the machinery of selection and period of induction which would favorably or unfavorably influence success.

Let us begin with the individual, rather than the State or the requirements of the Armed Forces. In a free democracy, as opposed to a tyranny, the government or State exists through the collective will of all citizens supporting their freely nominated representatives by secret ballot. The necessity for voting at agreed intervals so that representatives may be tested as to their views or record against those of a contrary opinion is inherent in the system. The pros and cons of policy are freely debated before the people. It is theirs to choose. To avoid a chaotic multiplicity of group views, those of similar views usually group themselves into as few parties as possible. Since strength must be met by strength, there is a natural tendency to form into two main groups. But in the nature of things there must be not less than two groups if democracy is to survive. One-party rule inevitably leads to tyranny and the abolition of the ballot.

The free democratic citizen then is conditioned to freedom of expression. Indirectly, but surely, he influences his country's foreign affairs and through his individual ballot influences war or peace. If, before war he is opposed to war at any price, it will take a great deal of persuasion to overcome his distaste if war occurs. In the final analysis, he, as a free citizen, has the right to his opinion one way or another. He is conditioned to fighting out the pros and cons of his viewpoint at the polls and accepting the majority verdict with more or less good grace. Unless he can understand that war was inevitable or necessary and not the result of mismanagement by the people's representatives, his aversion to war is understandable.

In a cross section of the population there are all shades of viewpoint and all varieties of individual circumstances and social and financial pressures varying with the times. If a man is of military age and total manpower mobilization is necessary he is faced with suddenly relinquishing his freedom and being told either to work at a specific occupation or be inducted into the services. The entire pattern of his life may be changed overnight. The farmer, the office worker, the merchant, or student, whether self-employed or independent, must give up what he is doing and enter into a strange environment. He is usually beset by many difficulties incidental to winding up his affairs, or making special provisions for his family. No matter how willingly he sets out, it is a period of great emotional stress and uncertainty. He has heard many tales of glory and of death. He wonders what the fates have in store for him and invariably hopes for the best. He is in a very receptive mood for a guiding hand and a

need for discipline and self-control among those whom he understands than among complete strangers. There is plenty of time for wider and wider associations. Haste should be made slowly. Administrative and training plans disregarding this important concept will surely cause futile manpower wastage.

Above all, the initial examination, indoctrination, and common basic training centers set up must be most carefully staffed. This is a key position which demands officers and noncommissioned officers who possess a knowledge of human relations and are favorably known and respected throughout the area for good character, integrity, justice, and inborn leadership. There is no place here for martinetts who know no other means of leadership than that of command through fear. There are unfortunately too many of them to be met later in the soldier's, sailor's, or airman's career, when it is hoped he has acquired a safer mental adjustment, or that the overt disciplinarian has been curbed through an enlightened policy. At the initial training center, the individual should begin to feel his common identity as a citizen and a soldier and that as a citizen he is not being set apart from others, but is to serve so as to most suitably express his free political will in opposition to the enemy. Having achieved that concept, his objectives become clearer. He can then settle down to pursue his mission in the war with resolution, knowing that the sooner it is successfully concluded, the sooner he can again employ his knowledge, experience, and new and old skills in the peaceful reconstruction which must follow.

The Armed Forces, however, can only proceed so far in their efforts to successfully utilize manpower. Unless the national morale has been so molded by national leadership both before and during war so that the masses of the people have pride and faith in their Armed Forces and the common cause, and wholeheartedly support them, the Armed forces cannot hope to achieve final success. In other words, the degree of faith and belief in the righteousness of the cause which is inherent in the national motivation and morale will directly determine the real effectiveness of the Armed Forces.



# About The Army Medical Department

## Medical Department Extension Courses<sup>1</sup>

HOWARD S. MCCONKIE, Colonel, M.C., U. S. A.<sup>2</sup>

EXTENSION courses of one or more of our Army schools are converted to correspondence courses. They were first used in the Armed Forces in March 1907 by the National Guard of the State of Indiana which at that time instituted a correspondence course in military medicine for its medical officers. In 1910, the War Department authorized a correspondence course for its medical officers, and in the following year the Army Field Service and Correspondence School for Medical Officers was organized as one of the Army Service Schools at Fort Leavenworth, Kans. This was authorized for members of the Regular Army Medical Corps only. The majority of our extension-course students today are Medical Service Corps officers and enlisted men desiring Reserve commissions in that Corps.

The Medical Reserve Corps of the Army was created in 1908. It was the first integral volunteer reserve ever organized in the Army. In 1915, a correspondence course was authorized for the several corps of the Medical Department Reserve. These were discontinued during World War I. They were reinaugurated at the Medical Field Service School at Carlisle Barracks, Pa., when the War Department established the army-wide correspondence system in 1922. That system remained in effect until the mobilization for World War II. Courses were prepared by the Medical Field Service School and were administered by the nine corps areas then in existence. Those subcourses<sup>3</sup> were normally graded by the Regular Army Medical Department personnel located nearest the student. Possibly such a grader was on

<sup>1</sup> Presented at First Army Medico-military Symposium, Governor's Island, 26 April 1950.

<sup>2</sup> Chief, Extension Courses Department, Medical Field Service School, Brooke Army Medical Center, Fort Sam Houston, Tex.

<sup>3</sup> Correspondence courses are herein referred to as subcourses.

are sent to the student, but when a selected subcourse is requested, the department occasionally must write the student and enclose a mimeographed list of titles showing current availability. Some alternate subcourse is then usually selected by the student. On the other hand, if it develops that he needs the specific subcourse requested as a means of preparing to teach that subject, we find the material he needs in some other department of the school.

Certain National Guard and ORC officers have been provisionally commissioned with inadequate military training and they are generally required to complete the "10" and "20" series within 1 or 2 years. Their subcourses are sent to them 3 at a time so as not to hold them back. In order not to hold any other ambitious student back, the subcourses are sent to a student as fast as he can take them.

Although a complete series of extension courses is not now a prerequisite for promotion in the Reserve, it is one method of fulfilling requirements so that an officer's commanding officer can consider him for promotion. It is desirable for all officers of the Medical Service Corps Reserve to take almost all subcourses from the MFSS and certain administrative subcourses of the Adjutant General's School, especially the one entitled, "Disposition of Records." The Quartermaster School course on "Bookkeeping and Accounting" is also recommended. Eight of the subcourses in other schools are of definite value to company-grade officers. One of these covers hospital construction and is recommended for medical officers who are training for staff and command positions.

Clinical officers should take certain subcourses selected to suit their needs. We do not expect them to take complete series of subcourses. We want to help those who definitely desire help through this medium of training. Professional officers for the most part are earning "points" by other methods. It is a positive challenge to maintain the interest of the medical officers of our Reserve forces in the Reserve program. This is more particularly and understandably so in extension courses. In all fairness these officers desire to remain active but do not have the time to participate.

Medical units are now being organized in a special manner. The present concept of tables of organization for medical units places almost all of the clinical officers in the Professional Complement section. It is considered that the unit will be organized and given extensive training before the professional complement reports to the unit. This means that tremendous basic and unit training responsibility must be assumed by a few officers and the enlisted cadre. Because the training of enlisted cadres is extremely important almost all applicants for extension course enrollment from enlisted men are approved. When these men finish the "10" series, they are permitted to take selected

subcourses in a higher series commensurate with their MOS or their unit or instructional assignments. Many Regular Army enlisted men, through their correspondence activity and proved applicatory capabilities, will be commissioned as second lieutenants in the Medical Service Corps where they will be of great value in a mobilization. In preparing subcourses those subjects dealing with problems to be met in an army in the field have been given preference with second priority being given to the supporting agencies of such a field army.

Some ORC unit commanders wish their personnel to take certain subcourses before their unit's 2-week summer training camp. More units will be required to take such summer training under the new ORC program. Every possible aid is given to such prerequisite extension training as is set up by these unit commanders.

Extension courses may be taken by all military personnel regardless of status. This includes those on the inactive and honorary lists of the Reserve. In view of the close similarity between civil-disaster medical service and medical field service for the Armed Forces, it is expected that the National Security Resources Board, which has charge of planning civil defense on the Federal level will be able to use certain subcourses on evaluating procedures for selected civilian medical and allied science leaders.

Because unification is the order of the day, officers of the Army, Navy, and Air Force may take subcourses in any of the three departments. They should apply for such subcourses through their own branch schools. In January 1950 the Navy had 12 medical subcourses. There are no tests on the lessons, the examination consisting instead of preparing a thesis on the subject matter. One Navy student is taking an Army course and one Army student is taking a Navy course. The Air Force has no extension courses especially prepared for medical personnel but at least 34 Air Force Medical Department Reserve officers are taking Army courses. There may be more because we have had to rely on the student to tell us when he has transferred to the Air Force.

Four new courses are being planned at the Medical Field Service School to parallel our resident instruction on the "Medical Aspects of Atomic Explosion."

Each time our students are circularized with a news letter, warning, or even a Christmas greeting, there is a renewal of activity. This is the reason for the periodic publishing of a news sheet called "Training Report," which is being replaced by the "Medical Department Organized Reserve Corps Training Bulletin." Each branch of the Army will soon publish such a bulletin for their branch. A Reserve officer is assigned full time to the Office of the Surgeon General, De-

The material for this edition has been compiled by Americans from American material. Every effort has been made to have each section written by a well recognized authority on the subject. There are 14 chapters and 2 supplements. Such important subjects as radiation therapy in "Diseases of the Blood and Blood-Forming Organs," the circulatory system, the respiratory system and breasts, the gastrointestinal tract, the female genital organs, the genito-urinary tract, the nervous system, etc., etc., to completely include the entire body and the glands of internal secretion. There is an outstanding and important chapter on "The Civil Liability of the Radiologist." The supplements discuss "Low Intensity Radium Needles" and "Dosage Calculation in Radium Therapy." This is an excellent book, not only for the radiologist, but for everyone in all the fields of medicine.—*Capt P Peterson (MC) U. S. N.*

INTRODUCTION TO NEUROPATHOLOGY, by Samuel Pendleton Hicks, M. D., Departments of

Company, Inc., New York, N. Y., publishers, 1950 Price \$10

This text achieves the aims of the authors to introduce to medical students and residents in neurology and pathology the fundamentals of disease processes in the nervous system, and to stimulate an interest among general pathologists and neuropsychiatrists toward a closer correlation of their respective viewpoints.

In this work, neuropathology is brought to the general pathologist as an integral part of general pathology, and is presented in such a clear and concise manner that the reader becomes unaware that he is studying a subject which has long been considered complex. The text itself is brief but sufficient, because it is profusely illustrated with excellent, both gross and microscopic, black and white photographs. Charts and schematic drawings are also used to definite advantage. Much of the data presented is based on original work of the senior author. The pathologic physiology of the nervous system is discussed adequately, but the clinical pathologic correlation is neglected. An entire chapter is devoted to congenital anomalies of the nervous system, while only one or two paragraphs are given to such conditions as Wilson's disease and other degenerative diseases of the nervous system which are of special interest to the neuro-psychiatrist.

The discussions may be too detailed for the medical student in his study of pathology. The bibliography is good and is quite sufficient. The general pathologist will receive the greatest benefit from this text because it brings neuropathology into the realm of general pathology, treating neurological disorders in their relation to the disease processes in the body as a whole. In spite of a few shortcomings the book is recommended to those interested in neurology and neuropathology.—*Lt (jg) P. K. Hamilton (MC) U. S. N.*

RESEARCH IN MEDICAL SCIENCE, edited by David E. Green, Ph. D., and W. Eugene Knob M. D. 492 pages The Macmillan Co., New York, N. Y., publishers, 1950 Price \$6.50

It is the thesis of the authors that medical research is no longer an arena for clinicians alone. It was their hope to bring a better understanding of fundamental science to clinicians and a better appreciation of medical problems to non-medical investigators. This they have undertaken to accomplish by a series of 26 essays surveying the methods and problems of various specialized fields which impinge on the field of medicine. Although primarily intended for the scientific groups centering around medical interests it is suggested that the intelligent layman will find this a readable book. This reviewer believes the book will prove

profitable and interesting for the scientifically inclined but will make rather heavy going for those who do not have a firm foundation in some field of science. It definitely is not aimed for the layman.

The Anglo-American team of editors has assembled an international list of outstanding authors. The authors have faced the challenge of the editors and have put a strong case for their respective fields. The essays stand independently and each is concluded with its own bibliography. Here Mennlinger describes psychiatry as a "science" (the quotation marks his) resting on five isolated and inadequately correlated methodological pillars; Burnett discusses viruses; Wolman describes sanitary engineering as an art even though he qualifies it as a hybrid; Montagu describes anthropology as the integrative science of man; and Ingalls approaches the problem of congenital deformities as an epidemic; many other equally stimulating presentations are included.

The book has a table of contents but no index.

Often one hears reference to the romance of the laboratory sciences. Here one feels it astir close at hand. Enthusiasm for the subject runs through these essays like the pulse of a feverish patient. The reader's problem is not to decide which will be interesting but rather which must be read first. This book is recommended for all those who feel they need a lift from the rut of their own specialty and for those who wish to round out their medical scientific background but are pressed for time. This book deserves a wide reading within the medical profession and the allied sciences.—Commander H. J. Alvis (MC) U. S. N.

#### BOOKS RECEIVED

Receipt of the following books is acknowledged. As far as practicable, they will be reviewed at a later date.

**STEREOLVAGE ROENTGENTHERAPY**, by Franz Buschke, M. D., Simeon T. Cantrell, M. D., and Herbert M. Parker, M. Sc., from The Tumor Institute of The Freedman Hospital, Seattle, Washington. 297 pages. Charles C Thomas, Springfield, Ill., publisher. 1950. Price \$10.50

**NON-VALVULAR HEART DISEASE**, by Henry A. Christian, A. M., M. D., LL. D., Sc. D. (Hon.), M. A. C. P., Hon. F. R. C. P. (Can.), D. S. M. (A. M. A.), Hersey Professor of the Theory and Practice of Physic, Emeritus, Harvard University; Sometime Clinical Professor of Medicine, Tufts College Medical School, Sometime Physician-in-Chief, Carney Hospital, Sometime Visiting Physician, Beth Israel Hospital; Physician-in-Chief, Emeritus, Peter Bent Brigham Hospital, Boston, Mass. (Reprinted from Oxford Loose-Leaf Medicine with the same page numbers as that work.) 75 pages. Oxford University Press, New York, N. Y., publishers, 1950. Price \$2.

**BACTERIAL INFECTION WITH SPECIAL REFERENCE TO DENTAL PRACTICE**, by J. L. T. Appleton, B. S., D. D. S., Sc. D., Professor of Bacteriology and Dean, The Thomas W. Evans Museum and Dental Institute School of Dentistry, University of Pennsylvania. 4th edition, thoroughly revised. 614 pages; Illustrated. Lea & Febiger, Philadelphia, Pa., publishers, 1950. Price \$10.

**A TEXTBOOK OF ORAL HYGIENE AND PREVENTIVE DENTISTRY**, by Russell W. Bunting, D. D. Sc., Professor of Dentistry and Dean of the School of Dentistry, University of Michigan, and collaborators. 210 pages; Illustrated. Lea & Febiger, Philadelphia, Pa., publishers, 1950. Price \$5.

**HANDBOOK OF PHYSICAL MEDICINE AND REHABILITATION**, Selections Authorized for Publication by the Council on Physical Medicine and Rehabilitation, American Medical Association. 573 pages; Illustrated. Published for the American Medical Association by The Blakiston Company, Philadelphia, Pa., 1950. Price \$4.25

**BIOLOGICAL STUDIES WITH POLONIUM, RADON, AND POLONIUM**, edited by Robert M. Fink, Ph. D., Associate Clinical Professor of Physiological Chemistry, School of Medicine, University of California at Los Angeles. Research Chemist, Birmingham

A GUIDE TO GENERAL MEDICAL PRACTICE, by Martin G. Vorhaus, M. D., Attending Physician, Hospital for Joint Diseases, New York City. 244 pages. The Macmillan Co., New York, N. Y., publishers, 1950. Price \$3.50

TEXTBOOK OF ENDOCRINOLOGY, edited by Robert H. Williams, M. D., Executive Officer and Professor of Medicine, University of Washington Medical School, Seattle, with the

A PRIMER FOR DIABETIC PATIENTS, by Russell M. Wilder, M. D., Ph. D. F. A. C. P., Professor and Chief of the Department of Medicine of the Mayo Foundation, University of Minnesota, Senior Consultant in the Division of Medicine, Mayo Clinic. 9th edition. 200 pages, Illustrated. W. B. Saunders Co., Philadelphia, Pa., publishers, 1950. Price \$1.25

NURSING CARE OF THE SURGICAL PATIENT (Formerly Textbook of Surgical Nursing. 4th edition, by McFee and Keller), by John Pettit West, M. D., Attending Surgeon, St. Luke's Hospital, New York; Assistant Attending Surgeon, New York Hospital, New York; Assistant Professor of Clinical Surgery, Cornell University Medical College, New York; Manelva Willie Keller II, R. N., Formerly, Chief Operating Room Nurse, St. Luke's Hospital, New York, and Anesthetist, St. Luke's Hospital, New York, and Elizabeth Hartman, B. A. R. N., Instructor in Surgical Nursing, Cornell University New York Hospital School of Nursing, New York. Assistant Head, Surgical Nursing Service, New York Hospital, New York. 5th edition 500 pages, Illustrated. The Macmillan Co., New York, N. Y., publishers, 1950. Price \$4.





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## Foreword

The UNITED STATES ARMED FORCES MEDICAL JOURNAL represents the unification of the BULLETIN OF THE UNITED STATES ARMY MEDICAL DEPARTMENT, published since 1922, and the UNITED STATES NAVAL MEDICAL BULLETIN, published since 1907. This joint periodical is the medium for disseminating information of administrative and professional interest to all medical personnel of the Department of Defense.

It is the aim to include in each issue administrative directives, original scientific and professional articles, editorial comments on current professional literature of special interest, clinical notes, descriptions of new devices and instruments, abstracts of articles from various medical periodicals, and notices and reviews of newly published professional books of interest to all commissioned medical personnel of the Department of Defense.

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RICHARD L. MEILING, M. D.,  
*Director, Medical Services,  
Department of Defense.*

RAYMOND W. BLISS,  
*Major General, U. S. A.,  
Surgeon General, U. S. Army.*

CLIFFORD A. SWANSON,  
*Rear Admiral (MC) U. S. N.,  
Surgeon General, U. S. Navy.*

HARRY G. ARMSTRONG,  
*Major General, U. S. A. F.,  
Surgeon General, U. S. Air Force.*

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UNITED STATES  
GOVERNMENT PRINTING OFFICE  
WASHINGTON : 1950

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F. W. FAERAK, *Editor in Chief,*

Captain, Medical Corps,

United States Navy

WAYNE G. BRANDSTADT, *Associate Editor,*

Colonel, Medical Corps.

United States Army

ALFRED A. GENTILCORE, *Associate Editor*

Captain, Medical Service Corps,

United States Air Force.

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moplegia, cranial nerve involvement, and other focal neurologic manifestations occur. Systemic reaction is slight. Fever is seldom above 101° F., and the leukocyte count and sedimentation rate are within normal limits. Terminally coma supervenes, and the usual cause of death is respiratory failure. The diagnosis depends on the isolation of the yeast from the sputum or spinal fluid, with proof of pathogenicity by animal inoculation. The diagnosis should be considered in any case of chronic meningitis, and in any patient with roentgenographic evidence of pulmonary infiltration without apparent cause.

In 1861, Zenker reported a case of cryptococcosis of the central nervous system which was the first reported case of cryptococcal infection in man (2). In 1902, Frothingham (3) described a yeastlike fungus infection producing a mass in the lung of a horse. In 1905 von Hansemann (4) in Europe reported a case of blastomycosis of the central nervous system, which probably was cryptococcosis. In 1912 Rusk and Farnell (5) reported 2 cases of "systemic oidiomycosis" in the United States that undoubtedly were cryptococcosis. In 1916, Stoddard and Cutler (6) established cryptococcosis as a definite mycotic infection, that fulfilled Koch's postulates, and named the incriminating organism *Torula histolytica*, now designated *Cryptococcus neoformans*. In 1937 Levin (7) carefully reviewed the literature up to that time which, with 2 cases he reported, amounted to 60 cases. In 1941 Binford (8) added 14 cases from the literature and his own experience. Voyles and Beck (9), reviewing the literature and cases of their own, up to 1946, accounted for 108 cases. Up to 1949, 6 known cases had been reported in Great Britain. In 1946 Cox and Tollmar collected data on 13 cases that had occurred in Australia in the preceding 10 years.

We have reviewed the literature since 1946 and have attempted to bring up to date the number of proved reported cases of cryptococcosis. Cases reported since Voyles and Beck's review in 1946 are as follows.

Rawson, Collins, and Grant (10) in 1948 reported a fatal case of central nervous system cryptococcosis, with systemic spread and necrosis of the adrenal glands with adrenal insufficiency. Mezey and Fowler (11) in 1946 reported one case of central nervous system cryptococcosis, in which they believed the toxic symptoms of the disease were caused by a toxin produced by budding yeast cells. Greening and Menville (12) reviewed 537,135 admissions to the Charity Hospital in New Orleans over a 10-year period and found only 4 proved cases. In 1947 Jesse (13) reported what he believed to be the first known case of cryptococcosis of the bone. Other cases have been reported by Hassim (14), Moody (15), Mider, Smith, and Bray (16), Neuhauser and Tucker (17), Reilly and Artman (18), Daniel, Schiller, and Volpp (19), and Frolo and Bailey (20).

*C. neoformans* in man more frequently involves the central nervous system, less frequently the viscera, nasopharynx, skin, lymph nodes, muscles, and bones. In the 60 cases reviewed by Levin in 1937 all infections involved the central nervous system. Of these 60 cases, 30 were reported as involving only the central nervous system, with 9 reported involving also the lungs, and 8 more being generalized, 1 of which did not involve the lungs. It is difficult to determine how many cases initially involved the lungs, but at least 16 cases in this report had lung manifestations in addition to central nervous system findings. Coincident involvement of the lungs occurred in 4 of Binford's 15 cases of central nervous system cryptococcosis, and in 1 of 6 cases of Reeves, Butt, and Hammack (21). Greening and Menville believed that in 83 of the 107 cases they reviewed the condition was confined to the central nervous system. In about 20 cases the lungs and the central nervous system were both involved, and in 4 cases the lungs alone were involved.

Reports of involvement of the lungs alone are rare and have been given by Sheppe (22) and Hardaway and Crawford (23), with an apparent recovery in the latter case. Sheppe reported a case, confirmed by necropsy, in which the right lung showed an organizing bronchopneumonia, with no evidence of central nervous system involvement. Hardaway and Crawford reported a case of cryptococcosis of the lung, in the absence of evidence of invasion of other organs, in which the patient remained under observation for 15 months, and when last seen was practically asymptomatic. The pulmonary lesions, however, showed little roentgenographic change during this time. They believed their case tended to confirm the opinion expressed by Stoddard and Cutler and Sheppe that cryptococcosis of the lungs offers a better prognosis than other types of infection with this organism.

The generalization of the mycotic process occurred in only 12 of 81 cases collected by Freeman (24), Levin, Binford, and Reeves, Butt, and Hammack, and invariably is fatal. There are a few cases in the literature in which the infectious process was localized and limited to certain parts of the body, and in which *C. neoformans* were recovered from the lesions. In 1906 Brewer and Wood (25) reported the first case of localized cryptococcosis, the case of a man with an abscess of the spine, apparently cured with drainage and curettage. Other localized infections with *C. neoformans* have been reported by McGehee and Michelson (26), Alvarez (27), Burger and Morton (28), and others.

The prognosis, except for the localized cutaneous type, is grave, especially in involvement of the central nervous system, which, until the advent of sulfonamides, was always fatal. Voyles and Beck stated



Figure 1.—India-ink preparation of direct smear from sputum showing characteristic morphologic appearance of *Cryptococcus neoformans* with large capsule and budding of the organism.

revealed budding cells with halo-like capsules morphologically characteristic of *C. neoformans*. Intraperitoneal injection of washings from these cultures into white mice caused the death of all injected animals within 5 days, and recovery of *C. neoformans* from them at autopsy. A roentgenogram of the chest on 10 September revealed a circular area of homogeneous density, about 5 cm in diameter, in the right middle-lung field (fig. 2). A lateral film of the chest placed the lesion in the right middle lobe (fig. 3). Subsequent roentgenograms showed no significant change in the appearance of the lesion. Skin tests for tuberculosis and histoplasmosis were negative but the skin test for *Coccidioides* was 3 plus. On 14 October a specimen of blood was sent to Dr C. E. Smith for complement fixation and precipitin test for coccidioidal infection, and both were reported negative. Dr. Smith reported, "We have had similar evidence that there is no cross reaction between cryptococcus and coccidioidal serologic tests."

The patient remained completely asymptomatic from the date of admission until 25 November when he complained of a slight dull headache on arising in the morning. On 28 September he was given an initial dose of 4 gm of sulf-

diazine and subsequently received 1 gm. every 4 hours, night and day, until 7 December, when he refused all medication. During the period of sulfadiazine therapy, the blood level averaged about 105 mg. per 100 cc. On 24 September, 10 drops of a saturated solution of potassium iodide were given three times daily, and the dose was increased 1 drop daily to a total dosage of 75 drops three times daily. During this period the patient showed no symptoms or signs of toxicity to either drug. On 27 November he was given 0.4 gm. of streptomycin four times daily, in addition to the sulfadiazine and potassium iodide. This medication was continued until 7 December. Spinal puncture, on 30 November showed initial pressure of 200 mm. The fluid was clear, and the Queckenstedt test, globulin, protein, and sugar were within normal limits. The cell count was 8, with 4 polymorphonuclear cells and 4 lymphocytes. An india-ink smear revealed yeastlike organisms, morphologically characteristic of *C. neoformans*. A spinal puncture on 14 December showed initial pressure of 340 mm with a rise to 420 on straining. The fluid was crystal clear, and again revealed, on india-ink preparations, organisms morphologically characteristic of *C. neoformans*.



Figure 2.—Roentgenogram showing circumscribed dense infiltration in the peripheral portion of the right middle-lung field with little surrounding reaction.

The abnormalities found at autopsy were confined essentially to the lungs and brain. The middle lobe of the right lung showed a peripheral firm gray nodule (fig. 4), measuring 4 by 5 cm. Sections taken from this nodule revealed a peripheral zone, in which the alveoli contained numerous round to slightly oval, thick-walled organisms, with broad capsule (fig. 5). The meninges, from the cerebral cortex to the cauda equina, were infiltrated by moderate numbers of yeastlike organisms. A smear of fresh brain by the India-ink method, revealed numerous organisms, morphologically resembling *C. neoformans*. Cultures of brain tissue and cerebrospinal fluid also revealed these organisms.

#### DISCUSSION

This case is reported not only because of the rarity of the disease and the complete pathologic report, but because it reopens the question of therapy. For years potassium iodide, in doses up to tolerance, has been used in the treatment of this disease for lack of a more effective drug. No cures effected by the use of this medication have been reported. Recently the use of sulfonamides has been advocated, and several cases have been described in which good results have been obtained, particularly as far as the prolongation of the life of the patient is concerned.

Smith (30) states that the prognosis is grave in all forms of cryptococcosis, but recommends that sulfadiazine be maintained in the blood at a level of 6 to 12 mg. per 100 cc. for a period of months. He further states that iodides have been of little value alone, but should be used to supplement the sulfadiazine. Voyles and Beck conducted experimental studies on animals infected with *C. neoformans* and came to the conclusion that potassium iodide and sulfadiazine, and a combination of the two drugs, showed no evidence of a beneficial therapeutic effect. In this experiment rats, rabbits, guinea pigs, and dogs were used.

Jones and Klinek (31) studied the therapeutic effect of sulfadiazine on experimental infections in mice and the effect of sulfadiazine and penicillin on organisms *in vitro*. They concluded that sodium sulfadiazine showed no demonstrable effect on *Cryptococcus*, that penicillin did not appear to inhibit the growth of the organisms *in vitro*, and that there was no known treatment of proved value.

Reilly and Artman experimented with white rats and concluded that sulfadiazine and streptomycin would prolong life, but that penicillin afforded slight benefit, and there was no advantage in combining penicillin and sulfadiazine. Vaccination employed in this study did not appreciably lengthen the life of the animals.

Solotorovsky and Bugie (32) reported that fungus infections have not responded well to chemotherapy. Penicillin and streptomycin have not been effective against fungi *in vitro*. This work confirmed that of Robinson, Smith, and Graessle (33), and Foster and Woodruff

(34). Bacitracin, polymyxin, and chloromycetin have not been shown to possess therapeutic activity against fungi that are pathogenic to man. Although streptothricin has been shown to inhibit the progress of cryptococcal infections in the mouse, according to Molitor (35) and Musheft and Martland (36) the use of this drug in human beings has not been effected because of its high toxicity in experimental animals. It was thought that streptothricin might be useful as a positive control for the evaluation of antifungal agents *in vivo*, but not for treatment in human infections. Other authors, commenting on penicillin, have reported it as affecting some strains of *Cryptococcus* but that it is of doubtful value in the treatment of patients.

Taber (37) stated: "the early surgical removal of a circumscribed area of torulosis seems as logical as the early removal of carcinoma." Surgery was not recommended in cryptococcosis of the central nervous system, or in generalized systemic spread. Dorner et al. (38) reported the case of a child with cryptococcosis of the right lung. The involved lobe was surgically removed, but central nervous system spread developed postoperatively. Froio and Bailey reported a case of pulmonary cryptococcosis in a 19-year-old man. The lower lobe of the right lung was surgically removed and 5 years and 7 months after the operation there was no evidence of meningeal spread or involvement of the left lung.

In our patient, lobectomy was seriously considered, because, on admission to the hospital, the roentgenogram of the chest and the finding of *C. neoformans* in the sputum were the only indications of cryptococcal infection; there were no cerebral symptoms at this time and the spinal fluid examination was negative. Sensitivity testing showed *C. neoformans* to be sensitive to polymyxin *in vitro*, but on actual treatment with this drug the infection did not respond. Other agents previously reported on, such as penicillin, streptomycin, sulfadiazine, and potassium iodide, to tolerance, were all used without success.

#### SUMMARY

A review of the literature revealed 127 proved cases of cryptococcosis to which one has been added. Although various therapeutic agents have been used in the past, no treatment has consistently proved beneficial in this disease. Patients showing pulmonary involvement of localized nature, in the absence of systemic spread, should be given the benefit of surgical removal of the involved lobe of the lung.

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# Tuberculin Testing of Midshipmen and Recruits of the Navy and Marine Corps<sup>1</sup>

ROBERT O. CANADA, *Commander (MC) U. S. N.<sup>2</sup>*

ROBERT W. BARIONE, *Captain (MC) U. S. N.<sup>2</sup>*

WHILE our information concerning the exact mechanism of the tuberculin reaction must be regarded as incomplete, it is now generally agreed that natural hypersensitivity to tuberculin is a result of tuberculous infection. In the clinical application of this fact it is very important to distinguish between tuberculous infection and tuberculous disease. From tuberculin surveys of our population and from autopsy material there is indication that the vast majority of tuberculous infections are promptly arrested and never produce tuberculous disease. Tuberculous infection, however, does leave its mark. The tissues of the host become sensitized to the products of *Mycobacterium tuberculosis* and this sensitization can be detected by the tuberculin skin test. The test, however, has its limitations. A positive result does not indicate the age of the infection or whether the infection is active or whether the infection has progressed to disease. It merely indicates that the person at some time in the past has been infected by *Myco. tuberculosis*.

Since January 1942 fluorograms of the chest have been a part of the routine examination to determine physical fitness of inductees and applicants for the Navy and Marine Corps. In the spring of 1948 the tuberculin test was made a part of this routine. The advantages to be gained from the mass tuberculin survey of recruits are considered to be as follows:

(a) The tuberculin test aids the roentgenologist and internist in deciding the significance of calcifications and infiltrates observed in the initial fluorograms.

<sup>1</sup> Read at the forty-sixth annual meeting of the National Tuberculosis Association in Washington, D. C., and scheduled for publication in "Transactions of the National Tuberculosis Association."

<sup>2</sup> Preventive Medicine Division, Bureau of Medicine and Surgery, Department of the Navy.

(b) The tuberculin test can be repeated when indicated, particularly in those persons exposed to tuberculosis, and close observation can then be made of those whose tests become positive.

(c) A repeat tuberculin test found to be positive and associated with a pulmonary infiltrate will serve not only as an aid in diagnosis, but also as an aid in determining the age and hence the significance of the lesion.

(d) The proportion of persons who have had a tuberculous infection prior to entering the service can be determined.

(e) A recorded negative tuberculin test on enlistment will assist in establishing or disproving service connection to tuberculous disease discovered later. If it is found that a substantial number of the men who have clinical tuberculosis incurred their initial infection while on active duty, it will indicate the need for better control measures within the service. The question of *Bacillus Calmette-Guérin* (BCG) vaccination can then be discussed on firmer ground.

This report deals with the results of tuberculin testing of recruits at one Marine Corps and two naval training centers during the last 9 months of 1948. With few exceptions, all recruits were tested within 4 days after reporting for active duty from civilian life (the freshman class at the U. S. Naval Academy was also included in the testing).

The tuberculin used for testing was the *Widal* . . . . prepared in tablet form . . . . sufficient material for

tests. Measured amounts of sterile distilled water were provided in ampules, so that when one tablet was dissolved in an ampule, the resulting solution contained 0.0001 mg of tuberculin per 0.1 cc. The test was performed by injecting 0.1 cc. of the tuberculin solution intradermally into the volar surface of the forearm. The test was interpreted 48 to 72 hours after injection of the antigen. The result was recorded as negative if there was no edema at the site of injection even if redness was present. A doubtful reaction was one of slight redness and a trace of edema measuring 5 mm. or less in diameter. A positive test was one in which redness and definite edema were present and measured more than 5 mm. in diameter. The degree of reactivity, as determined by the diameter of infiltration, was recorded as follows:

+ more than 0.5 cm, but not exceeding 1 cm.

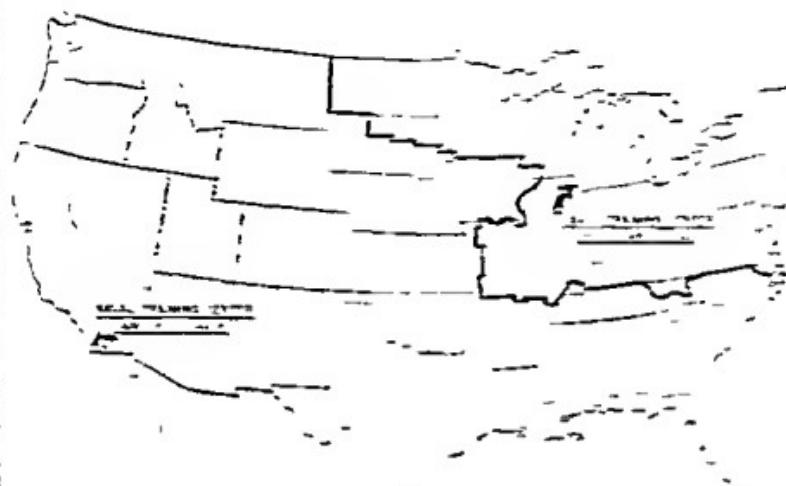
++ more than 1 cm, but not exceeding 2 cm.

+++ more than 2 cm.

++++ redness and edema plus an area of necrosis.

The results of tuberculin testing are shown in table 1. Of the 79,393 tuberculin tests performed, 7,675 or 9.7 percent were positive. Although the difference in the percentage of reactors between any 2 of

NAVAL RECRUITING AREAS



Please ..

TABLE 2—Reactions to 0.0001 mg PPD tuberculin

Reaction	Number	Percent	Reaction	Number	Percent
Total	79,303	100.0	+	3,199	4.0
Negative	70,872	89.3	++	2,420	3.1
Doubtful	844	1.1	+++	1,541	1.9
			++++	467	0.6

Table 3 shows the age distribution of the Navy and Marine Corps recruits enlisted during the calendar year 1948 and the midshipmen of the class tested. It will be noted that 72 percent of the Navy recruits and 88 percent of the Marine Corps recruits fall into the age groups 17, 18, and 19. The majority of the Navy recruits were 18 and 19 years of age. A correlation was made of the percentage of reactors in the various age groups for 10,000 Navy recruits. No significant difference was found in the percentage of positive reactors in any of the age groups reported.

TABLE 3—Percentage age distribution of Navy and Marine recruits, 1948, and midshipmen, class of 1951<sup>1</sup>

Age (years)	Navy recruits	Marine recruits <sup>2</sup>	Midshipmen	Age (years)	Navy recruits	Marine recruits <sup>2</sup>	Midshipmen
Total	100.0	100.0	100.0	21	4.2	2.0	8.2
17	13.6	24.1	6.0	22	4.1	3.2	3.5
18	33.7	37.2	14.0	23	3.2	6	1.2
19	35.0	22.5	35.3	24 or over	1.5	4	1
20	9.9	7.2	37.7		3.9	7	1

<sup>1</sup> From "Statistics of Military Personnel, Navy and Marine Corps," 1948.<sup>2</sup> Marine recruits enlisted July-December 1944.

It should be pointed out that Navy and Marine Corps recruits are not representative of the general population because of factors other than the restricted age groups. For example, men with obvious physical defects, including tuberculosis, either do not apply for enlistment or they are disqualified by physical examination at the recruiting station and do not reach the training center. The percentage of Negro recruits is less than 3 percent and somewhat lower than that found in the general population of the United States. Men with delinquent or criminal records are barred from enlistment. Since enlistments during 1948 were voluntary, the young men who were inspired to obtain a college education are not represented.

Do the results of tuberculin testing as presented indicate that at least 90 percent of the young men enlisting in the Navy and Marine Corps have not been infected with *Myco. tuberculosis*? This question certainly cannot be answered with an unqualified "yes," although there is fairly good support for an affirmative answer. In evaluating the tu-

berculin test there are many factors that must be considered. First are the factors that bring about a false negative test. It is known that the degree of hypersensitivity or allergy wanes with the years and that after an innocuous first infection a person may show a degree of allergy so slight that it will not be detected by the ordinary doses of antigen used in testing. The age of the recruits here reported reduces the chance for this possibility. There are other conditions which depress tuberculin allergy but fortunately these, such as fever, the exanthemas, and overwhelming tuberculous infection, are infrequent in occurrence and obvious when present.

There is good evidence to substantiate the statement that false positive reactions occur when the dosage of tuberculin is sufficiently great. Furcolow et al. (1), in titration studies of tuberculin, found that a dose of 0.0001 mg. PPD (the same as used in the study here reported) was sufficient to provoke a reaction of 5 or more millimeters of induration almost uniformly in those persons tested having known tuberculosis, and in a high proportion of those giving a history of contact with tuberculosis. This dose, on the other hand produced relatively few reactions among children considered free of the disease and without known exposure. However, when the dose of tuberculin was successively increased, almost all the persons tested eventually reacted to the antigen, including infants and young children without evidence of tuberculous infection or history of contact. It is improbable that such a high proportion of children were actually infected with tuberculosis. The explanation advanced by the authors is that, with the use of higher doses of the antigen, nonspecific reactions appear with increasing frequency. Palmer and Peterson (2) state that infections with other acid-fast bacilli, nonpathogenic for man, may result in a state of hypersensitivity which is detectable by tuberculin when high doses are used in testing.

The "first" and "second" strengths of PPD tuberculin are commonly employed in this country in performing the intradermal (Mantoux) test. The "second" strength (0.005 mg. per dose) is 250 times as strong as the "first" strength (0.00002 mg. per dose) and 50 times as strong as the "intermediate" strength (0.0001 mg. per dose) used in the mass survey of Navy and Marine recruits. It was decided to retest a sample of the nonreactors and a sample of the doubtful reactors using the "second" strength tuberculin.<sup>2</sup> The samples were picked at random and without knowledge of the roentgenographic findings. As shown in table 4, 63 percent of a group of 450 non-reactors to the 0.0001 mg. dose gave a positive reaction when retested with the 0.005 mg. dose. A group of 50 doubtful reactors to the

<sup>2</sup> PPD-S supplied by Field Studies Branch, Division of Tuberculosis, U. S. P. H. S.



# Motion Sickness

FRED HARBERT, Captain (MC) U. S. N.<sup>1</sup>

MAURICE SCHIFF, Lieutenant Commander (MC) U. S. N.<sup>1</sup>

MOTION sickness is that disability produced by acceleration and deceleration or rotation in any plane. The abnormal motions produced by trains, automobiles, and aircraft are usually less in degree or continuity than those produced by ships so that seasickness is the most classical example of motion sickness. Other examples of motion sickness are elevator sickness, swing sickness, and the vertigo produced by whirling as in some forms of dancing and skating. The vehicle or mechanism producing changes in acceleration is unimportant.

The sense of equilibrium is not a single sense as, for example, hearing is the sense of the cochlea; it is the function of several organs, the most important of which are the labyrinth, the proprioceptive sense, and vision. Fish are suspended in water which uniformly distributes its pressure on their external surfaces. They depend mainly on the labyrinth to determine their relationship with the force of gravity: of course, the labyrinth is well developed in these aquatic animals.

In terrestrial animals contact with gravity is made through only a small portion of the body surface, i. e. the feet, the supporting force of air being negligible. To maintain equilibrium, it is important that the proprioceptive sense be well-developed and such is the case. Birds, while flying, develop forces which counteract gravity so that mere equilibrium is not sufficient; orientation or reference to distant as well as proximate and internal environment is necessary. This is supplied mainly by vision. Man, without instruments, cannot fly without visual contact with the earth.

Many theories on various causes of motion sickness have been advanced, but the most popular are the labyrinthine and proprioceptive theories. The former contends that continuous stimulation of the vestibular apparatus by movements causes reflex nausea similar to

<sup>1</sup>U. S. Naval Hospital, Philadelphia, Pa.

that produced by the caloric or rotation tests. Strong support for this theory is the experiment that bilateral labyrinthectomy in four susceptible dogs rendered them nonsusceptible to motion sickness. On the other hand, no positive correlation between caloric tests and susceptibility to motion sickness could be demonstrated (1).

Vertigo and nystagmus which is characteristic of stimulation of the semicircular canals is not a characteristic symptom of seasickness. Advocates of the vestibular theory state that the symptoms are not primarily due to stimulation of the semicircular canals but to the utricle and perhaps saccule which record vertical movements and motion of translation respectively. In this connection it is interesting to note that ascent is usually the motion least tolerated. This motion is recorded in the utricle. Pitching, rolling, and yawning, in the order named, are usually the most offensive.

Another explanation suggested for the maximal effect of vertical movements is the change in filling of the large vessels of the head and neck, thus stimulating the carotid sinus with resultant changes in the autonomic nervous system (2). There is no experimental evidence to substantiate this theory.

Proprioceptive sense is mediated through the afferent impulses normally arising in muscles, tendons, and joints. Normally the body maintains its equilibrium largely by unconscious reflex action initiated by these afferent impulses plus those from the labyrinth. In tabes dorsalis these somatic impulses from the lower extremities may be abolished by disease of the columns of Goll and Burdach. Vision helps compensate for this loss, but the patient falls when in the dark or when blindfolded. Deaf-mutes in whom the labyrinths are absent, have no difficulty in maintaining their equilibrium when blindfolded. These facts have been cited to indicate that the proprioceptive sense is more important in equilibration and, therefore, in the causation of seasickness. It is a well-known fact that on lying down the symptoms of seasickness are ameliorated. This probably occurs because of the elimination of the stimuli from the righting reflexes originating in the skeletal system in the erect posture.

Relief by wearing a tight binder to minimize visceral movements has been reported. In running and other gymnastics, nausea and vomiting do not occur yet the visceral movement is certainly greater than that incident to the comparatively gentle roll and pitch of a vessel at sea. Young healthy recruits are as susceptible to seasickness as older viscerototic persons in whom greater visceral movements should theoretically cause greater stimulation. These facts tend to discredit the visceral theory; in fact, objections can be found to any theory which incriminates a single organ or system.

Visual impressions are most important in orientation and equilibrium. Many people become nauseated when objects are passed rapidly before their eyes; discrepancy between the visual sense of motion and the proprioceptive and labyrinthine sense of stability probably accounts for the vertigo. Skaters and dancers by fixing their vision on a stationary object for a moment during each revolution neutralize the disorientation produced by spinning. Another method of avoiding symptoms is to snap the head in a direction opposite to that of the spin. This neutralizes the excessive labyrinthine stimulation produced by spinning. Suturing the eyelids or fixing the animal in plaster casts reduces an animal's susceptibility to motion sickness.

Strong or offensive odors such as exhaust gas, tobacco smoke, and cooking odors may precipitate symptoms.

It thus becomes apparent that motion sickness is not the result of stimulation of a single organ. It is the result of a break in accommodation by the spinal and medullary centers from continual unusual stimuli arising in many organs. In the order of importance, the senses are probably vestibular, proprioceptive, visual, and then the others. An important factor in this breakdown is a discrepancy in the sensations from various senses. Sensations from the labyrinth, somatic, or other senses are not unpleasant per se; it is the abnormal reflexes produced by these sensations that are unpleasant. Stimuli from various organs normally cause automatic and usually unconscious adjustments of the body to changes in its relation to the force of gravity. These sensations are correlated and integrated in cerebellar, medullary, and spinal centers. When these centers are repeatedly subjected to unusual stimuli, particularly when the stimuli are inconsistent, a point is finally reached when they cause more than the proper reflexes. A spill-over to other medullary and higher centers occurs, thus producing the symptoms of motion sickness. The break in accommodation may be quite sudden. In the midst of a conversation, the victim may be suddenly overwhelmed by nausea and vomiting. Just as accommodation can be broken, it can be acquired or regained. When this occurs on board ship the passenger is said to have acquired his "sea legs." This desirable state occurs when the spinal and medullary centers compensate for the motion of the ship and impulses no longer spill over to other centers. After a prolonged voyage, this adjustment to a periodically heaving deck may become so habitual that it continues when the passenger lands and the ataxia produced ashore has been referred to as "land sickness."

The symptoms of any organic disease are largely influenced by psychic factors and this is particularly true of mal de mer. These psychic factors are so commonly found that the entire symptom-complex is sometimes erroneously called functional. The fact that ani-

mals, including trained seals, and even fish, have been reliably reported seasick should be sufficient to refute this theory. Individual susceptibility to seasickness varies greatly. Some persons claim that they are never seasick; as a rule they are phlegmatic.

The nausea which affects a student aviator on making preparation for a hop, or the ship's passenger before the ship leaves the dock, is purely functional and should not be designated air or seasickness. It is probably a conditioned reflex based on association with previous experience and fear. The ease with which nausea and vomiting can often be precipitated by suggestion in a passenger already experiencing symptoms, is another example of the psychic influence.

In addition to simple conditioned reflexes there is also the complex effect of mental attitudes including memory, association, and fear. In airsickness, especially, the unsatisfactory rationalization of fear is a great factor. Whenever sea legs are lost without a distinct change in the periodicity of the ship's movements or when airsickness occurs in an experienced pilot who is not subject to airsickness, the cause is usually psychogenic. Most persons adjust well to the usual motion encountered at sea but an adjustment to a certain type does not prevent symptoms from developing when the motion changes its periodicity or becomes much greater. This type of seasickness should not be considered psychogenic. A person who rides comfortably on a battleship or ocean liner may be completely incapacitated on a destroyer or seagoing tug. Some individuals always remain susceptible and are vulnerable whenever they go to sea. Naval personnel have a small percentage of such cases even among old salts. Lord Nelson of Trafalgar fame was a victim of seasickness during his entire naval career.

In an analysis of unusually susceptible persons, 66 percent were found to have neurotic tendencies as compared with 23 percent in persons less susceptible to motion (3). That seasickness is often used as an escape mechanism is not doubted. The lethargy and mild depression produced by incipient motion sickness may justify an avoidance of responsibility or inadequacy in performing duties. Intense interest, on the other hand, may hold symptoms in abeyance. An emergency requiring action may dissipate the symptoms of motion sickness and, in general, persons who perform necessary or purposeful activity acquire "sea legs" much sooner than those who remain idle.

The symptoms of seasickness vary. The mildest consist merely of a slight depression, aversion to tobacco, food, and odors, and a dull occipital headache. There may be increased awareness of the epigastrium and increased yawning. Increased salivation and nausea are premonitory symptoms before the characteristic vomiting which is of the projectile central type. Pallor and cold sweating are usually present. Retching may continue spasmodically and is attributed to

spasmodic contraction of the diaphragm. The slow pulse and respiration, pallor and sweating, and subjective symptoms are similar to those produced by vagus stimulation as in excessive smoking. A sympathetic tonic form characterized by restlessness, excitability, and insomnia has also been described. The facial expression of great dejection accurately records the patient's sensations.

Tests made on seasick patients showed an increase in blood sugar, a decrease in phosphorus, and a normal electroencephalogram; no correlation was observed between instability and susceptibility. Electrocardiograms, blood pressure, and blood gas studies were also normal (1).

#### TREATMENT

General hygienic measures a day or two before sailing with avoidance of last minute parties, bustle, and nervous tension are advantageous. The motion of the ship often produces insomnia in persons not seasick. In such cases a barbiturate such as nembutal is excellent. Since the multiplicity of new and unaccustomed stimuli has much to do with causing seasickness, steps to reduce his reaction to stimuli should be taken by the susceptible passenger. Lying down with the eyes closed or reclining in a deck chair facing away from the sea, will reduce both visual and skeletal reaction to stimulation. Good ventilation and absence of odors is of great help. Physical exertion tends to minimize the effect of the sea because of the purposeful motor activity. Walking and sports tend to reduce the tendency to lethargy when at sea. Reading is usually difficult and ambitious reading programs planned for a trip usually are never carried out. In the Navy, mild forms of seasickness are usually ignored and sea legs are acquired while the recruit busies himself with ship's work.

Atropine, hyoscine, and hyoscyamine have been prescribed because they inhibit the vagus or parasympathetic nerves. This seems rational because the symptoms are characteristic of overstimulation of the parasympathetic nerves. Undue hypnosis, dryness of the mouth, and other side effects are often noted with these drugs. The barbiturates, preferably one of the quick-acting ones as seconal or nembutal, are probably useful adjuncts in the early phases; besides alleviating apprehension and worry, they reduce the sensitivity of the medullary centers and so facilitate adjustment.

Until recently these methods were the best available. In November 1948, a clinical study of motion sickness was undertaken to determine the effectiveness of a new drug (dramamine) on seasickness (2). The effects of dramamine on personnel in each compartment of an army transport were observed and, as a result, the following conclusions were recorded: (a) When used prophylactically, 29 percent of those

treated by placebo were seasick as compared with 1.4 percent of those treated with dramamine. (b) All persons showing active symptoms of sickness were relieved by dramamine within half an hour. Side effects were minimal.

Dramamine is apparently a nontoxic, powerful, prophylactic, and therapeutic drug when used to control the symptoms of motion sickness.

We have used dramamine in the treatment of Ménière's disease with dramatic symptomatic relief of vertigo. Since May 1949 we have routinely used dramamine for the relief of postoperative vertigo following the fenestration operation. While nystagmus was usually unaffected, all other unpleasant symptoms such as vertigo, nausea, and vomiting were largely eliminated. The benadryl component of dramamine has an atropinelike action as well as anesthetic and mild hypnotic effects (5). Recent experiments indicate that dramamine affects the central nervous system above the level of the vestibular nuclei but not the labyrinth (6).

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# Vagus Resection

## A Study of 19 Cases

LAWRENCE L. BEAN, *Captain (MC) U. S. N.<sup>1</sup>*

MARSHALL P. STONESTREET, *Lieutenant, junior grade (MC) U. S. N.<sup>1</sup>*

**T**HREE has been so much controversy about vagus resection, with or without gastric drainage, that this article is written to present in detail the pre- and post-operative findings in 19 cases of vagus neurectomy.

There are two operative approaches to the vagus nerve, trans-abdominal and transthoracic; the individual case will determine the approach. In 18 cases, an abdominal approach through the left rectus muscle was used.

The only outstanding disadvantage of the transabdominal operation is that all the nerve trunks may not be severed. In one patient, there were two main nerves and one accessory. In all other patients, there were from two to five accessory or connecting nerve fibers which required excision. One worker reported that 8 percent of the nerve trunks are not definable infradiaphragmatically. The disadvantages following the transthoracic approach are: (a) the intra-abdominal lesion cannot be explored, (b) persistent postoperative thoracic pain may be present, (c) there is no opportunity to perform a concomitant intra-abdominal procedure, and (d) secondary surgical procedures may be necessary (13).

Vagus resection for the treatment of peptic ulcer has been studied by numerous investigators for many years. It was advocated by Stierlin in 1920. The stimulus for this research was originated by Pavlov in 1890, when he demonstrated that gastric function was influenced by the vagus nerve. This was later confirmed by other workers in the twentieth century (1).

Dragstedt (4) (5) (6) (7) stressed the use of vagus resection in cases of peptic ulcers with complication and those resistant to medical treatment, and especially emphasized the effect of the operation on the first period of gastric secretion—that of interdigestive or continuous secretion. It seems likely that certain aspects of the second period, digestive secretion, are favorably affected (2). This second

<sup>1</sup>U. S. Naval Hospital, Long Beach, Calif.

or digestive period has been divided into the cephalic, gastric, and intestinal phases. The cephalic phase occurs when secretion and motility are influenced by mental stimuli; the gastric phase, when secretion and motility are stimulated by contact of gastric mucosa with secretagogues or food; and the intestinal phase, when chyme is being propelled and secretion enhanced by the presence of the bulk.

Vagus resection is of therapeutic value only if the operative procedure is complete, and if all the vagus fibers are severed as described by Weinstein et al. (3). Dragstedt (4) (5) (6) (7) was the first to report bilateral vagus resection.

Starvation feeding and the use of insulin are the two methods for evaluating the completeness of vagus resection. Of these, the latter was considered the most practical in this study, since standard doses of regular insulin and accurate laboratory facilities were available. The effect of insulin hypoglycemia on the stomach has been studied thoroughly—it is thought to cause an increase in gastric motility (8) (9) (10) (11). The mechanism of action is considered to be a central vagal effect and there occurs an increase in gastric motility and secretion due to hypoglycemic stimulation of the vagus center (3) (12). Complete vagus resection abolishes these actions.

The relief of pain is not associated with evidence that pain pathways have been divided, as judged by postoperative balloon distention observations. Pain is still perceived in response to stimulation of the esophagus, duodenum, and jejunum, as shown by Moore et al. (14), and also when hydrochloric acid is introduced into the stomach, as shown by Dragstedt. It appears more probable that relief is due to decreased acidity or motility, or to both (2).

Merely because complete vagus resection is followed by immediate relief of pain, clinically, does not mean that excessive vagus stimulation is the cause of peptic ulcer. A patient may not be benefited by vagus resection, even though he is free from pain because vagal activity is not the pathogenic factor. A disorder such as aerophagism, masked gallbladder disease, or psychonemrosis may have been the basis of his syndrome. The vagus nerve is important in the interdigestive phase and in the gastric, cephalic, and intestinal phases of the digestive period.

A review of the literature on vagus resection in the treatment of peptic ulcer indicates that there are four questions to which answers should be obtained in order that physicians may evaluate this procedure. These questions are: (a) Are patients with peptic ulcer clinically benefited by the operation, and if so, what are the indications, contra-indications, and complications? (b) What demonstrable physiologic gastrointestinal changes are produced by resec-

tion of the vagus nerve? (c) How long do these physiologic changes persist? (d) How long do patients remain well from a clinical and roentgenologic standpoint (14)?

No treatment of peptic ulcer can be fully evaluated until it has been in use for a period of from 15 to 25 years.

### CASE REPORTS

**Case 1.**—Three years before admission this 36-year-old man noted epigastric pain and dyspepsia. A duodenal ulcer was demonstrated by roentgenogram. An ulcer regimen was instituted with regression of symptoms on two subsequent occasions; finally intractable pain developed. At operation an ulcer was seen in the first portion of the duodenum; vagus resection was performed.

Convalescence was uncomplicated except for persistence of three to four watery stools daily, beginning 1 month following discharge from the hospital. Five months later a gastroenterostomy was performed but the diarrheal symptoms continued for 7 more months until, under psychotherapy at a foreign base hospital, the patient was readjusted. Following this, he remained asymptomatic.

A gastrointestinal series 3 weeks, 9 months, and again 16 months after operation, failed to show any ulcer. The results in this case were satisfactory, after the gastroenterostomy and psychotherapy.

**Case 2.**—This 40-year-old man had had a duodenal ulcer for 4 years; characteristic epigastric ulcer pain had been relieved by food. Two massive hemorrhages had previously occurred 2 years apart. Gastrointestinal series revealed a small ulcer on the lesser curvature of the pyloroduodenal junction. No gastric retention was present. After 1 month of medical treatment without improvement a vagus resection was performed. No other procedure was considered necessary since the pylorus was sufficiently patent.

The postoperative course was uncomplicated, and recovery uneventful.

Eighteen months after vagus neurectomy this patient was working daily and was asymptomatic except for occasional mild gaseous distention.

**Case 3.**—For 2 years before admission to the hospital, this 38-year-old man had been having mild epigastric pain. He had received no treatment. Four months after the onset of his pain, hematemesis and several tarry stools occurred, followed by severe epigastric pain which was unrelieved by food or antacids. On admission, roentgenographic studies showed a small ulcer niche on the inner aspect of the duodenum. Gastric emptying was normal. Intractable pain continued and after 3 weeks of medical care an exploratory laparotomy was performed. A nonobstructing ulcer on the anterior surface of the duodenum was seen and vagus neurectomy was performed. His convalescence was satisfactory. Roentgenogram 1 month postoperatively showed the duodenal ulcer to be healed; the patient had returned to work. Eighteen months after operation the patient had infrequent episodes of vomiting and gaseous distention.

**Case 4.**—In this 23-year-old man a duodenal ulcer was demonstrated roentgenologically 2½ years prior to admission. Following this he had two gastrointestinal hemorrhages, and 2 weeks before admission he had severe intractable epigastric pain accompanied once by hematemesis. He was not relieved after 3 weeks of medical treatment. Roentgenograms showed an ulcer in the first portion of the duodenum with scarring and no obstruction. A vagus resection was performed.

Convalescence was satisfactory. Roentgenogram 2 months following the operation showed no ulcer. Sixteen months later the patient was definitely improved; he was free from pain although he had postprandial eructation on rare occasions. Two years later, he had a recurrence of symptoms. Medical treatment for 6 weeks gave no relief. Another operation was performed and the ulcer was still present. Examination of the site of vagus resection revealed it to be incomplete, the left vagus nerve was intact. It was sectioned as usual and a partial gastrectomy performed. His symptoms were completely relieved, and have remained so.

*Case 5*—For 4 years this 47-year-old man had had a peptic ulcer. A bland diet and antacids were prescribed but epigastric pain accompanied by vomiting occurred occasionally. A roentgenogram showed a small niche along the greater curvature of the duodenal cap. After 2 weeks of medical treatment he still had intractable pain. No retention was present. At operation a duodenal ulcer was found on the first portion of the duodenum. A vagus resection was performed.

Fifteen months after operation he began vomiting and vomited about once every 2 or 3 months but he had no pain.

*Case 6*—An ulcer had been present in this 42-year-old man for 5 years. Treatment with a bland diet and antacids controlled the symptoms until 5 weeks before admission when intractable pain accompanied by vomiting occurred. One massive gastrointestinal hemorrhage had occurred 2 years previously.

Roentgenogram showed an ulcer in the greater curvature of the base of the duodenal cap. No obstruction. The condition failed to respond after 1 month of medical treatment. At operation the ulcer was identified and a vagus resection performed. The postoperative course was uncomplicated.

Fourteen months postoperatively he began to have daily vomiting and persistent moderate gaseous distention. A bland diet was continued. Nine months after operation some vertigo was present and he fainted three times during the summer months. Fainting did not occur in the 4 months following the summer episodes. During these episodes he found that eating sugar and honey prevented fainting.

His postoperative condition was not considered satisfactory. Perhaps a concurrent gastroenterostomy would have been of benefit.

*Case 7*—This 35-year-old man gave a history of duodenal ulcer and of episodes of diarrhea and melena for 17 years. A posterior contraperistaltic gastroenterostomy was performed at this hospital 2 years earlier. The patient on readmission complained of intractable epigastric pain. At operation a marginal ulcer and a fistula between the gallbladder and first portion of the duodenum were found. A vagus resection was performed. One month later a cholecystectomy was performed.

The postoperative course was uneventful. He returned to work 2 months after operation; his only complaint was occasional gaseous distention.

*Case 8*—Four years before admission to this hospital, a diagnosis of peptic ulcer was made in this 27-year-old man. During the following period he had one severe hemorrhage. Medical treatment gave him no relief from epigastric pain and dyspepsia. A gastric resection and anterior contraperistaltic gastrojejunostomy were performed. Following this he gained 34 pounds but 1 year later he had to return to the hospital because of severe intractable epigastric

pain which did not respond to treatment. At operation a marginal ulcer was found and a vagus neurectomy was performed.

Convalescence was uneventful. Three weeks later no ulcer was demonstrated on roentgenographic examination. Eighteen months following vagus resection he was free from pain and only had vomiting when emotionally upset.

**Case 9.**—Six years prior to admission this 52-year-old man had had a gastroenterostomy at a civilian hospital. He remained asymptomatic for 3 years. In the next 3 years two episodes of severe gastrointestinal hemorrhage occurred. In the past year although the epigastric pain was relieved by food and antacids, there was a weight loss of 10 pounds in 3 months. Gastrointestinal series showed an ulcer of the duodenal cap and some obstruction at the pylorus and a normally functioning posterior gastroenterostomy. After 3 weeks of medical treatment an operation was performed. A marginal ulcer was found and a vagus resection was performed.

The postoperative course was uneventful. Roentgenograms 3 weeks following operation revealed no ulcer.

Seventeen months following vagus resection, the patient complained of nausea and vomiting two to three times a week and also had a moderate amount of gas postprandially. He had no pain. He took a regular diet. Physical examination showed no abnormality and therefore it was considered that his complaints were psychosomatic in origin.

**Case 10.**—This 47-year-old man, during a 9-year period before admission, had had two massive hemorrhages and a gastroenterostomy that was performed 8 years earlier. He was asymptomatic until 1 month before admission, since then burning epigastric pain, lasting 15 to 20 minutes, occurred one-half hour following meals. He had lost 12 pounds of weight. One day previous to admission, a massive gastrointestinal hemorrhage occurred and continued for 3 days. Three weeks later, a roentgenogram showed a functioning posterior gastrojejunostomy with evidence of marginal irritability. There was a partial obstruction at the pylorus and an ulcer crater on the lesser curvature of the stomach. After 1 month of treatment epigastric distress was still present. An operation revealed a cicatrizing ulcer on the first portion of the duodenum. A vagus resection was performed.

His convalescence was satisfactory. Roentgenograms made 3 weeks and again 2 months following vagus resection showed no ulcer. Seventeen months after operation the patient was much improved. Constipation which was present before the operation was relieved. He had three episodes of 8 to 9 watery stools per day for 4 days—2 weeks, 1 month, and 15 months after operation. By eating 4 or 5 small meals daily he gained 10 pounds in weight.

**Case 11.**—Nine years previous to admission this 52-year-old man completely recovered from tuberculous epididymitis which was treated with drainage. Seven years before admission, he had a cholecystectomy, and 6½ years prior to admission he had a partial gastrectomy for duodenal ulcer.

His complaints on admission were compatible with marginal ulcer and this was demonstrated by roentgenogram. Medical treatment failed to relieve his symptoms. A transhernial vagus resection was performed and this was followed by complete relief of symptoms for 13 months.

Two months postoperatively the patient sustained a spontaneous compression fracture of the second and third lumbar vertebrae, and 4 months later he had a spontaneous fracture of the spinous process of the right scapula. On two occasions the serum calcium was 15 mg. per 100 cc. and the serum phosphorus

9 mg per 100 cc. The basal metabolism rate was +23, +33, and +28. Multiple myeloma, Cushing's disease, and hyperparathyroidism were ruled out. Whether the vagus resection was responsible for this condition or whether its occurrence 2 months after vagus resection was coincidental is not known.

**Case 12**—Fourteen years previous to admission this 37-year-old man had a peptic ulcer which was demonstrated by roentgenogram. Eight months prior to admission a partial gastric resection was performed at another institution. He remained asymptomatic for 4 months when burning epigastric pain occurred, this finally became intractable. At operation a marginal ulcer was found and a vagus resection was performed. Convalescence was uneventful. Twelve months post-operatively the patient had no vomiting and only had occasional mild gaseous distention.

**Case 13**—For 28 years prior to admission this 54-year-old man had had symptoms of peptic ulcer for which 16 years prior to admission, a partial gastrectomy and gastroenterostomy were performed. He was admitted with a jejunocolic fistula. A resection of the jejunum, repair of the transverse colon, partial gastrectomy, and a new anterior contraperistaltic gastrojejunostomy were performed. Three months later, the patient was readmitted because of intractable pain, on gastrointestinal series extreme tenderness was found at the site of the new stoma. At operation, a jejunal marginal ulcer was found and a vagus resection was performed.

The postoperative course was uncomplicated. Three months later the patient was asymptomatic except for occasional slight gaseous distention following meals.

**Case 14**.—This 31-year-old man had symptoms of peptic ulcer for 3 years. Repair of a perforated peptic ulcer had been performed 2 years after the onset of his symptoms. Following this he had intractable epigastric pain. Hospitalization and appropriate treatment failed to give him relief. The pain became constant, dull, and gnawing in character. Tarry stools occurred on several occasions. A gastrointestinal series showed a duodenal ulcer.

At operation one old healed, and one active duodenal ulcer were found. A gastrojejunostomy (posterior isoperistaltic) and vagus neurectomy were performed.

A gastrointestinal series 4 weeks later showed a healed ulcer of the duodenum. The patient's condition 20 months after operation was poor because of the persistence of frequent episodes of vomiting and gaseous distention. It is believed that this patient required psychotherapy for readjustment since many of his complaints were not consistent with the physical findings.

**Case 15**—This 65-year-old man had had intermittent "dragging" pain in the right upper quadrant of the abdomen associated with "gas" and eructation for 15 years before admission. During this entire period he had been on an ulcer regimen. The pain gradually increased in severity but was usually relieved by food and antacids. He had had three episodes of severe hematemesis during this period.

Röntgenologically, a gastric ulcer on the lesser curvature of the stomach was found. Gastric emptying was normal. At operation, a vagus resection was performed. Three weeks postoperatively a roentgenogram showed no ulcer. Improvement was noted 3 months postoperatively and 10 months following operation he was free from pain, although vomiting occurred about once a week and mild gaseous distention was occasionally present in the afternoon. Two years postoperatively a laparotomy for duodenal diverticulum was performed; the ulcer was found to be completely healed.

**Case 16.**—Five years before admission, this 39-year-old man was discharged from the Army because of peptic ulcer. His pain was relieved when he adhered to treatment. His symptoms recurred 4 years after discharge and again 5 months later. Medical management and hospitalization for 1 month gave him no relief and a vagus resection and gastroenterostomy were performed. Convalescence was satisfactory, but 2 weeks postoperatively he had delusions and a diagnosis of schizophrenia was made.

Roentgenograms made 2 months and again 14 months postoperatively showed no ulcer. Sixteen months following operation the patient reported that he had one episode of vomiting monthly and had gaseous distention at infrequent intervals. He took a regular diet (except for pickles and onions).

**Case 17.**—For 9 years the patient, a 33-year-old man, had been taking a bland diet because of a peptic ulcer. Two episodes of severe hiccups developed during this period, the last one occurring at the time of his admission to this hospital. Medical treatment was instituted and continued for 6 months but he had no relief. A roentgenogram showed a scarring deformity in the duodenal cap. There was no obstruction. Operation revealed an old ulcer on the anterior portion of the duodenal cap and a traction diverticulum. A posterior gastrojejunostomy and vagus resection were performed and the diverticulum was freed from its adhesions.

A gastrointestinal series 3 weeks postoperatively showed no ulcer. Sixteen months postoperatively the patient was improved although he had vomiting and mild gaseous distention at infrequent intervals.

**Case 18.**—This 47-year-old man had symptoms of intermittent nausea, vomiting, and diarrhea for 1 month. A duodenal ulcer was found on roentgenogram. Medical treatment for 2 weeks failed to give him relief. At operation a large ulcer which perforated into the liver, and dense adhesions which caused a traction diverticulum of the duodenum were found. A gastroenterostomy, release of the traction diverticulum, and a vagus resection were performed. After 18 hours the patient suddenly died. At autopsy the cause of death was found to be pulmonary embolism.

**Case 19.**—Eight years before admission a diagnosis of duodenal ulcer was established in this 32-year-old man. His chief complaint was slight hematemesis on several occasions. He was admitted because of severe epigastric pain not associated with nausea and vomiting. Treatment for 3 weeks was unsuccessful. At operation a large ulcer crater was found in the duodenum. A vagus resection and posterior isoperistaltic gastroenterostomy were performed.

The postoperative course was uneventful. Two months later, roentgenograms revealed no ulcer. Three months postoperatively he had vomiting once or twice a week and gaseous distention in the morning after eating. Because of the repeated symptoms this patient is not considered to have been satisfactorily improved, even though he had no pain.

## DISCUSSION

Of the 19 patients, 17 are living. A follow-up study for a period of 8 months to 2 years was done in 17. One died as a result of pulmonary embolism 18 hours following operation, and one died after an automobile accident. The actual mortality in this series is, therefore, 5.3 percent. Eighteen transabdominal resections and one transthoracic

vagus resection were performed. Fourteen, or 83 percent, showed satisfactory improvement in that they seldom had nausea or vomiting. All had complete relief from pain. An attempted explanation for the "failures" is offered. In a great number of these patients the complaints stemmed from psychosomatic impulses. To treat any patient with peptic ulcer, a full realization and understanding of their psychosomatic make-up, as well as a knowledge of the pathologic nature of the disease is indispensable.

*Group I (table 1).*—Six cases had vagus resection as the primary operation. These patients had fewer complications, a shorter duration of symptoms, and excellent results should have been obtained. Yet, two of the six required additional operation and one patient had a poor functional result.

TABLE 1.—*Vagus resection without other operation*

Case number	Age (years)	Duration of symptoms preoperatively (years)	Previous operation	Indication	Postoperative result
1. .	36	3	None	Pain	Poor required further operation.
2. .	40	4	do	Pain and Bleeding	Good
3. .	38	2	do	do	Do
4. .	33	2½	do	Pain	Poor required further operation
5. .	47	4	do	do	Good
6. .	42	5	do	Pain and bleeding	Poor

*Group II (table 2).*—The next seven cases had had previous gastric operations and had developed marginal ulcers with pain and bleeding as the most common complaints. Vagus neurectomy was successful in six cases. The seventh case was improved. The last six cases had some form of gastric drainage in addition to vagus neurectomy. This proved more satisfactory as five of the six patients had a good result.

TABLE 2.—*Marginal ulcer*

Case number	Age (years)	Previous gastroenterostomy (years)	Previous gastric resection	Indications	Post-operative result
7. .	35	2	1 year	Marginal ulcer	Good
8. .	25	—	6	do	Do
9. .	52	—	—	do	Poor
10. .	42	8	—	do	Good
11. .	52	1½ years	—	do	Do
12. .	37	8 months	—	do	Do
13. .	34	16 years	—	do	Do

Group II includes those patients with marginal ulcer who have had previous gastric resection or gastroenterostomy. The symptoms were

intractable pain or bleeding or both. In this series of 7 patients, 6 (86 percent) were satisfactorily improved. The one who failed to improve had had a gastroenterostomy 6 years previously (case 9), and this patient required careful psychiatric readjustment. The average age in this group was 43 years.

*Group III (table 3).*—Group III includes those patients with intractable pain or bleeding, or both, and in whom either gastric resection or gastroenterostomy was performed at the time of vagus resection. In this series of 6 patients, 5 survived. One died with pulmonary embolism 18 hours postoperatively. Of the 5 who survived, 3, or 60 percent, had satisfactory improvement. The average age in this group was 41.

TABLE 3.—*Vagus resection combined with other surgical procedure*

Case number	Age (years)	Gastro-enterostomy	Gastric resection	Indications	Postoperative result
14 .....	31	Yes .....	No .....	Pain and bleeding do	Poor
15 .....	65	No .....	Yes .....	Pain ..do ..	Good
16 .....	39	Yes ..	No ..	do ..	Do
17 .....	33	Yes ..	No ..	do ..	Do
19.....	47	Yes .....	No .....	do ..	Death (due to pulmonary embolism 18 hours postoperative)
10.....	32	Yes.....	No.....	do.....	Poor.

Each patient had pre- and post-operative roentgenograms and the insulin-acidity test of Dragstedt. In all the cases complete vagus resection was performed as indicated by Dragstedt tests. The average preoperative Dragstedt tests were free HCl, 39°; total acid, 67°. Extreme high, 50° to 108° (in case 7). Extreme low, 20° to 30° (in case 9).

Postoperative Dragstedt tests average free HCl, 6°; total acid, 52°; extreme high, 20° to 110° (in case 7); extreme low 0° to 16° (in case 9).

Cases 7 and 10 are included in the improved group with their Dragstedt tests as follows: case 7, free HCl, 50°, total 108°; postoperative free HCl 20°, total 110°; case 10, free HCl 62°, total 78°; postoperative free HCl 34°, total 64°.

In the treatment for peptic ulcer the result as determined by the patient, in the final analysis, is the index of cure. Vagus resection, *per se*, is not a specific method for the treatment for the ulcer, and the interpretation of results by chemical analysis and by roentgenogram is not sufficient proof of the efficacy of the treatment. It is evident, however, that definite benefit has been obtained. There has been no recurrence of bleeding; pain has been relieved, and repeated periods of hospitalization have not been required.

Postoperative complications which occur are, gastric dilatation immediately postoperatively; diarrhea which occurs after convalescence; and pulmonary embolism which may occur after any surgical procedure. Of the three patients who had diarrhea, two were affected only intermittently every 1 to 2 months and were free from diarrhea 1 year prior to this report (cases 9 and 11). In one patient diarrhea persisted for 9 months until he was relieved by psychotherapy (case 3).

#### SUMMARY

Nineteen case reports of vagus resection are presented. The post-operative period of observation which ranged from 8 to 24 months is too short, and the number of cases too few to draw any definite conclusions. However, vagus resection is of value in relieving the intractable pain in peptic ulcer patients. It appears to be a good operation when other types of surgery have failed. It is effective in most cases of marginal ulcer. If pyloric obstruction is present, some type of drainage should be utilized at the same time. Many patients with peptic ulcers have an underlying psychosomatic condition which will not be relieved by any type of operation.

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# Army Field Surgeon, Specialist

*ROBERT P. WILLIAMS, Brigadier General, MC, U. S. A.<sup>1</sup>*

**I**N THE next war we can be sure of two things, casualties will be produced on an unprecedented scale and there will be scant time to train medical officers after the war starts. Recognizing that all medical officers should have training in the care and handling of casualties in the field, Maj. Gen. Raymond W. Bliss, the Army Surgeon General, in the August 1950 issue of the Armed Forces Medical Journal, announced the plan for field training of medical officers. A new company officers' course, lasting about 4½ months, will begin in the fall of this year at the Medical Field Service School, Fort Sam Houston, Tex. Following this the students will continue for an additional 4½ months at the Army Medical Service Research and Graduate School in Washington, undergoing instruction in recent advances in field medicine which are applicable to war conditions. Graduates of the course may then be given 2 years of applicatory duty in which they will serve as unit surgeon or company or platoon commanders in medical battalions. Also, beginning in September 1950, the Medical Field Service School will offer an advanced course of about 9 months. This course is primarily for older officers who have been on professional duty. It may be followed by 2 years of duty as division or corps surgeon, or in the office of an army or theater surgeon, or in the Medical Section of the Office of the Chief of Army Field Forces.

All of this is definitely specialization. The specialty has been termed army field medicine and those who practice it could be known as army field surgeons. No special Military Occupational Specialty (MOS) has been assigned to it. The Medical Section of Army Field Forces and the Surgeon General's Office are now engaged in studying the criteria appropriate for such an MOS.

Many elements enter into the duties and responsibilities of the army field surgeon. First he must be qualified in two different professions: the medical and the military. To practice medicine in the field or in combat, he must not only be proficient in medicine and surgery but also he must be able to obtain results with the limited facilities available and under such adverse local conditions as excessive heat or cold.

<sup>1</sup> Chief of Medical Section, Office of the Chief of Army Field Forces.

mud or dust. Although major surgery is not ordinarily attempted in the forward field installations, it sometimes becomes necessary and it is for such circumstances that the army field surgeon must be prepared. In addition to having a wide knowledge of the more common medical specialties, he must be trained in tropical medicine and in the recognition and treatment of conditions peculiar to his environment. As a staff officer he will advise his commanding officer on medical and sanitary matters. This will require a broad understanding of preventive medicine applied on the basis of familiarity with the organization, duties, and mission of the military unit. Finally, the army field surgeon in many instances is a commanding officer, responsible for the training, discipline, and morale of his medical unit. Although his command may be small, it calls for a high degree of leadership. Having trained his men in a variety of technical skills, he will find that many of them, such as company aid men, litter bearers, and ambulance drivers, will be employed away from his immediate control. Often they will be busy while other members of the unit are resting. Their skill and morale must be such as to inspire confidence because the patients they handle when they are on their own must have respect for their judgment and believe that they are in proper medical hands.

It is proposed that the MOS for the army field surgeon be in grades A, B, C, and D as are the medical professional specialties. Details are now being worked out. Only the broad principles can be announced at this time.

For instance, Grade D might be awarded on satisfactory completion of the company officers' course at the Medical Field Service School followed by 2 years of applicatory duty with a field medical unit. Because most of these officers on attaining this specialty rating will be assigned next in Army hospitals or on residency training, they will retain the MOS as long as they are in company grades. On promotion to field grade, requalification by attending the advanced course at the Medical Field Service School and by 2 years applicatory duty will be required.

Higher classifications in this MOS would be reserved for officers who enter army field medicine as a career. Grade C might be awarded a medical officer holding a D rating who is also a graduate of the Infantry, Artillery, or Armored School and of the Command and General Staff College. Grade B would require a short course in preventive medicine at the Army Medical Service Research and Graduate School and also graduation from the Armed Forces Staff College. Grade A would be reserved for medical officer graduates of the Army War College. Each of these school courses must be followed by an applicatory tour of duty with a field unit or a refresher professional assignment in an Army hospital.

In the study of appropriate criteria for the various grades of the MOS for the army field surgeon, cognizance will be taken of the fact that some officers now beyond the age limit for several of the service schools, nevertheless have had field or combat experience which might be considered equivalent to such school courses.

The response thus far to the reopening of army field medicine as a field for both general training and specialization has been very encouraging. Many medical officers engaged in recent maneuvers have voiced interest in field work and have inquired particularly as to what provisions are being made for this specialty.



# The Clinical Use of Antibiotics

## II. Prophylaxis of Infections<sup>1</sup>

PERRIN H. LONG, Colonel, MC, A. U. S.<sup>2</sup>

TOO MUCH hope has been placed in the prophylactic use of the sulfonamides and antibiotics against infection. Although in many instances this hope has not been justified, medical and dental officers should take advantage of the known prophylactic uses of the antibiotics.

### CHOLERA

Experimental data<sup>3</sup> indicate that the administration of 2 to 4 grains of chloramphenicol a day might constitute effective prophylaxis against cholera. Such a regime could only be recommended for trial during an epidemic period, and in persons who were contacts of patients with cholera, or who through their occupation were exposed to infection. Such prophylaxis, if started, should be continued until the chance of contracting cholera is past.

### GONOCOCCAL INFECTIONS

The observations of Harry Eagle and his coworkers indicate that the oral administration of a single dose of 250,000 units of crystalline penicillin G within a few hours after a sexual exposure to gonococcal infection will prevent the occurrence of this disease in a high percent of instances. Certainly, the intramuscular administration of 300,000 units of procaine penicillin G in aqueous suspension is effective in preventing gonococcal infection.

### HEMOLYTIC STREPTOCOCCAL INFECTIONS

The experience during World War II clearly indicates that the use of sulfonamides for prophylaxis in the mass of hemolytic streptococcal

<sup>1</sup> The second of four articles on this subject. The first appeared in the August issue.

<sup>2</sup> Department of Preventive Medicine, Johns Hopkins University School of Medicine, Baltimore, Md.

<sup>3</sup> GARIB, R. L., SCHINGMAN, A. S.; JACKSON, E. B.; MANNING, M. C.; and HESTON, M. C.: Chloramphenicol (chloromycetin) in experimental cholera infections. J. Bact. 57: 319-332, Mar. 1949.

infections in man is unwise. Whenever this procedure was attempted on a large scale, it was followed by outbreaks of infection produced by strains of the hemolytic streptococci which were resistant to sulfonamides. While similar experiences in man were not obtained with penicillin, there is a likelihood that the same result might be obtained if the latter drug were used under similar conditions. The only time when it is feasible to attempt the prophylaxis of hemolytic streptococcal infections is in relatively small groups that are closed, such as in orphanages, hospitals, penitentiaries and aboard ship. If penicillin is used, give 100,000 units by mouth four times a day for 3 or 4 days. If penicillin is not available, one of the sulfonamides (preferably sulfadiazine or sulfamerazine) given in appropriate doses would probably prove successful. As with penicillin, the sulfonamide employed should be given over a period of 3 or 4 days. Recent experimental tests with aureomycin seem to indicate that this drug in doses of 1 to 2 grams a day can be used as a prophylactic agent against hemolytic streptococcal infections. Certainly, if experimental data can be carried over into the clinical field, it would appear that streptococci will not easily develop a high degree of resistance to the antibacterial effects of aureomycin.

#### MENINGOCOCCAL MENINGITIS

The prophylaxis of this disease in men may be effected by the administration of one of the diazimes or penicillin. In adults, 2 grams, three times a day administered for 1 day to all persons exposed to infection will arrest an epidemic of meningitis. This effect will be maintained until invasive strains of the meningococci once more appear in the group that has been treated. There is little doubt that the administration of penicillin in doses of 250,000 units every 4 hours would accomplish the same purpose.

#### OPHTHALMIA NEONATORUM

Since in most States the Credé method for the prophylaxis of ophthalmia neonatorum is required by law, and any variation from this method is illegal, the use of penicillin for this purpose cannot be recommended. Also, the frequency with which sensitivity is produced by the use of penicillin in the conjunctival sacs makes this an undesirable method for the prophylaxis of gonococcal infection in the eye. If, however, the Credé method appears to have failed, then treat with crystalline penicillin G in doses of 5,000 units given intramuscularly at intervals of 3 hours. Frequently apply an ophthalmic ointment containing 100,000 units of crystalline penicillin G per gram to the conjunctivae. This will bring about a cure within 2 or 3 days.

### PUERPERAL SEPSIS

Unless otherwise contraindicated, every woman in prolonged or difficult labor should receive 0.5 gram of aureomycin by mouth at intervals of 6 hours during the period of labor and for 48 to 72 hours afterwards. If this antibiotic is not available, use procaine penicillin G with added crystalline penicillin G given intramuscularly in aqueous suspension at intervals of 12 hours during the period of difficult labor and for 24 to 48 hours afterwards.

### RHEUMATIC FEVER

The administration of 1 grain of sulfadiazine daily to children 3 to 12 years of age who have had one or more attacks of rheumatic fever, during the period in which they are exposed to hemolytic streptococcal infections (generally 15 September to 15 May) will protect most of them against a recurrence of the rheumatic infection. Penicillin by mouth will produce the same effect. If crystalline penicillin G is to be used, a suggested dosage would be 100,000 units four times a day by mouth for the first week of each month during the period in which the child is exposed to infection. The usual checks used in patients undergoing prolonged sulfonamide therapy should be observed.

### SUBACUTE BACTERIAL ENDOCARDITIS

*It is very important to place every person who has a quiescent rheumatic fever or an organic heart lesion on specific chemotherapeutic or antibiotic prophylaxis before performing operations in or about the mouth, throat, nose, or intestinal tract. This injunction includes the extraction of teeth. Use procaine penicillin G with crystalline penicillin G added. Give 2 hours before the operative procedure and repeat once or twice or more as conditions seem to indicate at intervals of 12 hours after the operation. Other preparations of penicillin may be used if the one recommended is not available. Lacking penicillin, use aureomycin in doses of 2 grains a day.*

### SURGICAL CONDITIONS

*Clean surgical operations.—*Although there are a certain number of surgical procedures that are known as "clean" and in which under normal conditions the incidence of postoperative infection is less than 10 percent, in certain special instances such as cataract extraction, corneal transplantation, and intraocular operations in which the conjunctivae are infected, postoperative infection is to be avoided at all costs. In such patients (if adults) give procaine penicillin G with crystalline penicillin G added in aqueous suspension intramuscularly 2 hours before operation and repeat at intervals of 12 hours for 4 doses

after the surgical procedure has been completed. Start 12 hours before the operation and continue for 48 to 72 hours afterward. Lacking penicillin, use streptomycin in doses of 2 grams a day, starting 24 hours before operation and continuing for at least 3 days afterward.

*Colonic operations.*—The oral administration of sulfonamides and/or antibiotics that are bacteriostatically active in the gastrointestinal tract may be used as a pre- and post-operative measure for decreasing infection incident to colonic operations. Originally sulfagnamidine was used for this purpose; later, sulfasuxidine or sulfathalidine was used. In the last few years a combination of sulfasuxidine and streptomycin by mouth, or aureomycin or chloramphenicol has replaced the use of the sulfonamides. The aim in this type of therapy is to so lower the bacterial content of fecal material in the colon that the risk incident to soiling the peritoneal cavity or the wound itself will be greatly lessened. It is difficult to say which is the method of choice for pre- and post-operative preparation of the bowel for surgical procedures. If a combination of sulfasuxidine and streptomycin is used, give 1 gram of sulfasuxidine every 4 hours and 1 gram of streptomycin every 6 hours by mouth for 4 days before the operation and then continue this regime for from 7 to 10 days post-operatively. If chloramphenicol is to be used, 1 gram four times a day over the same period could be used. With aureomycin the dose would be 0.5 to 0.75 gram four times a day.

*Pulmonary operations.*—In surgical procedures that are being performed in infected or potentially infected areas of the lung, it is a good plan to do everything possible to minimize the spread of infection prior to, during, and after operation. As pulmonary infections are generally caused by a mixture of gram-positive and gram-negative bacteria, the antibiotic of choice for the control of the infection would be aureomycin. It should be administered in the doses recommended for moderately ill patients for 4 days before the operation and postoperatively for 7 to 14 days, depending on the patient's general condition. Chloramphenicol, given in the doses recommended for moderately ill patients, may also be used to minimize the spread of infection incident to pulmonary operations. If these antibiotics are lacking, a combination of procaine penicillin G and streptomycin, both given intramuscularly, could be used.

*Established surgical infections.*—It is a good plan, if the surgical treatment of an established infection has been decided on, to administer a sulfonamide or antibiotic before and after operative procedures have been completed. This will frequently prevent the spread of the infection and will tend to insure a rapid and eventful convalescence. The agent of choice should be the antibiotic that is known to be most effective against the infecting organism and safest.

for the patient. If time permits, it should be administered for from 24 to 48 hours prior to operation, and then it should be continued for from 5 to 7 days (or longer if indicated) after the surgical procedure has been completed. The dosage of the agent usually should be based on those used for the treatment of moderately ill patients (or suitable variations of those schedules).

*Impending surgical infections.*—This is the term and conception which Col. E. D. Churchill, Surgical Consultant, Mediterranean Theater of Operations, U. S. Army, developed in respect to what was then termed "prophylaxis of wound infection" during World War II. All wounds that result from external violence are probably contaminated and/or potentially infected with micro-organisms. In the treatment of impending infection in wounds, the choice of the antibiotic should be made with special reference to the one that has the widest range of action against bacteria. At present this is aureomycin; hence it should be used in adults in doses of 0.5 gram four times a day in the treatment of impending surgical infections. Lacking aureomycin, use 300,000 units of procaine penicillin G with 100,000 units of crystalline penicillin G added, and give intramuscularly in watery suspension at intervals of 8 to 12 hours. Crystalline penicillin G or procaine penicillin G in vegetable oil with 2 percent aluminum monostearate added may also be used in the treatment of impending surgical infections.



## Uncommon Antibiotics

DICLOFENAC is derived from spoiled sweet clover. In addition to its effect on prothrombin, it is antibacterial for gram-positive bacteria and inhibits *Staphylococcus aureus*, *Staph. albus*, and *Staph. pyogenes* in a dilution of 1:50,000.

PETROLEUM is derived from *Penicillium patulum* and appears to have some effect against gram-positive and gram-negative bacteria commonly present in the nasopharynx. It is used in a solution of 1:10,000 as a topical application or as a nasal spray.

TOMATIN is obtained from the "Red American" and "red currant" tomato plants. It is active against *Staphylococcus aureus* and *Bacillus subtilis* and is highly effective against certain human dermatophytes belonging to *Fungi imperfecti* such as *Trichophyton mentagrophytes*, *Epidemophyton floccosum*, and *Microsporum canis*.

THIOPROPANATE is obtained from cultures of *Pseudomonas pycnophlebia*. In a 1:5,000 dilution it inhibits the growth of pathogenic fungi such as *Ichthyophthirius schoenherri*, *Microsporum gypseum*, *Trichophyton gypseum*, and *Candida albicans*.

HEMPPOXYANINA is obtained from cultures of *Ps. pycnophlebia*. It is active in dilutions of from 1:20,000 to 1:60,000 against *Ichthyophthirius schoenherri*, and *Candida albicans*. However, from a clinical report by Hopkins et al., hemppoxyanina appears to have no advantage over commonly used fungicides.

SICKLEBED CARRAGE releases a substance bactericidal to *Bacillus coli* and, to some extent, to *Staphylococcus aureus*. Peters and Fisher reported this in 1944.

# Relation of Nitrate Nitrogen Concentration in Well Water to the Occurrence of Methemoglobinemia in Infants

KENNETH F. MAXWELL, M.D.<sup>1</sup>

IN 1945 Comly (1) advanced the hypothesis that the so-called idiopathic methemoglobinemia<sup>2</sup> in infants may be caused by the ingestion of well water containing large amounts of nitrates. In the 4 years that have elapsed since the publication of Comly's article, this hypothesis has received much attention and the observations that have been made establish its validity. During this period, a large number of cases of methemoglobinemia in infants have been reported (2) (3) (4) (5) (6) (7) (8) (9) (10) (11) (12) (13) (14) (15) (16). In every case the baby had been fed on an artificial formula made with cow's milk, condensed milk, or milk powder *diluted with well water*. None of the infants was breast-fed only. Usually the wells from which the water was obtained were dug rather than drilled, had inadequate casings or none at all, were unsatisfactory with regard to location and construction, and, in many instances, showed evidence of pollution. Where the well water was subjected to chemical analysis, with two or three questionable exceptions, it was found to have a high content of nitrate of nitrogen and occasional traces of nitrites.

In some cases it was observed that with temporary discontinuance of the formula, the cyanosis produced by the methemoglobinemia cleared up only to reappear when artificial feeding was resumed. When the formula was changed to one made up of water having low nitrate nitrogen content, the cyanosis disappeared. If untreated,

<sup>1</sup> Consultant to the Surgeon General, Department of the Army.

<sup>2</sup> Methemoglobinemia designates the presence of methemoglobin in the blood. Some portion of the heme in the oxyhemoglobin molecule has been oxidized, ferrous ions being converted into ferric ions. Oxygen is so firmly bound that it cannot function in respiration. The color of the blood is changed from the normal deep red to a chocolate brown, giving a cyanotic tint to the skin. Methemoglobinemia may result from the ingestion and absorption of such drugs and chemicals as aniline, nitrobenzene compounds, acetanilid, sulfonamides, chlorates, and bismuth subnitrate.

of location and construction and showing no evidence of bacterial pollution, were found to have high nitrate content.

TABLE 2.—Concentration of nitrate nitrogen in wells not implicated<sup>1</sup>

	Concentration of nitrate nitrogen in p. p. m.					Over 100
	0-9	10-20	21-50	51-100	Over 100	
Dug wells:						
Schools ..	45	1	1	0	0	0
Farms .....	30	11	13	13	2	
Drilled wells:						
Schools ..	22	0	0	0	0	
Farms .....	51	9	4	0	0	

<sup>1</sup> From reference 17.

The cases of methemoglobinemia so far reported have a peculiar geographic distribution. They have originated in Iowa, Illinois, Minnesota, Nebraska, Missouri, Kansas, Michigan, Indiana, North Dakota, New York (two cases), Manitoba, Saskatchewan, and Ontario. The significance of this geographic concentration in the North Central United States and the central Provinces of Canada is not yet clear. The first question to be answered is whether this geographic concentration of cases is real or apparent. Physicians are not required to report methemoglobinemia to health authorities. Present-day knowledge of the occurrence of cases is derived from voluntary reports in journals and the published results of special inquiries undertaken in a few States, centering about Iowa, where the condition was originally described. It must be conceded, therefore, that the geographic limits of the occurrence of this condition have not yet been established by systematically collected information. Nevertheless, it seems unlikely that with the attention given this subject in medical journals, it would have escaped recognition in other parts of the United States and Canada. While the area from which cases of methemoglobinemia are reported may, in time, be enlarged, there is justification for the assumption that the geographic concentration of cases is a significant fact that requires explanation if intelligent preventive measures are to be taken.

One hypothesis is that it is directly related to the frequency with which infants are placed on artificial formulas made with well water in the first few months of life. While this frequency would undoubtedly vary in different parts of the country and with social, economic, and cultural backgrounds, the variation would hardly seem to be sufficient to play a major role in the geographic distribution of cases. A second hypothesis is that in this particular section of the country well waters with high nitrate count are more frequently encountered than in others.

The following summarizes our knowledge on this subject (28):

The ground waters of the United States contain varying amounts of nitrate derived from many sources. Among these are human and animal wastes and both organic and inorganic fertilizers. In some instances nitrogenous industrial wastes may give rise to high nitrate waters. However, ground waters may have a high nitrate content in areas where no such sources are present, or are present to an extent much too small to account for the large amount of nitrate. The source of nitrate in such cases has not been explained.

There are undoubtedly variations in the amount of nitrogenous material present at the surface or within a water-bearing formation and the rate at which it becomes available in the form of nitrate. The differences in the amount of nitrate from place to place are influenced by the rate of circulation of the water, the amount of recharge and location of recharge areas, the location of discharge areas, and the length of time that present conditions have existed.

The Geological Survey has made many thousands of chemical analyses of ground waters collected in all parts of the country during the past several decades. In general, natural waters do not contain more than 5 to 10 p. p. m. of nitrate. In a few areas in the United States nitrates in ground waters are found ranging up to 100 p. p. m. or even more. Such occurrences have been observed in Texas, Kansas, New Mexico, and in a number of other Western localities. Nitrate concentrations up to several hundred p. p. m. are not unusual in certain parts of Texas.

While only preliminary studies have been made of these data, it is apparent that the nitrate in ground water is not affected materially by rainfall or that the nitrate salts are being continuously replenished. There appears to be little relation between the occurrence of high nitrates in ground waters and the intensity of developments in the area. In Texas most of the waters containing high nitrate were obtained from wells less than 200 feet deep. We do not know definitely the relationship of high nitrate concentrations of ground waters to the geologic age of the water-bearing sands. Indications are that in Texas the formations of a younger age usually may be expected to yield a greater preponderance of high nitrate waters.

No map showing the location of these areas of high nitrate concentration in the United States has been compiled, but there is definite information that numerous rural private (household) wells in Texas yield water containing 22 to 133 p. p. m., and Oklahoma reported an average nitrate content of 28 p. p. m. for 415 wells with a maximum concentration of 638 p. p. m. (27). The experience of New York State (27) is reflected in the results of chemical examinations made from 1943 to 1946, inclusive, in connection with the supervision of public and private water supplies. In this period, 18,013 samples from ground water sources, wells, and springs were analyzed. Of these, 175 (all from private water supplies) had a concentration of 20 p. p. m. or more of nitrate nitrogen distributed as follows:

	Concentration of nitrate nitrogen p. p. m.			
	20-30	31-40	41-50	51-100
Number of samples	-	-	112	30
			8	19

Although the proportion of such supplies is small (1 percent of the total) in comparison with the frequency reported in the North Central States, it is not negligible. As yet only one authenticated and one suspicious case of methemoglobinemia has been recognized in New York and none in Oklahoma or Texas. Such observations could be extended by reference to other reports.

A similar observation has been made with regard to public water supplies secured from wells and springs. Such supplies are carefully protected from pollution and in general rarely have more than 20 p. p. m. of nitrate nitrogen. Occasionally, however, supplies are encountered that have much higher concentration. For example, of 550 public ground-water supplies in Illinois only 2 were shown to have a nitrate nitrogen content greater than 45 p. p. m. (29). A 95-foot well at Harrisburg, Ill., was found to yield water of 123 p. p. m. nitrate nitrogen after 3 minutes of pumping. An 80-foot well at Mt. Pulaski, Ill., was found to contain 274 p. p. m. of nitrate nitrogen on one occasion and 83.5 on another. In neither instance was there evidence of pollution. The water at Mt. Pulaski had been in use for over 40 years.

It would be expected that, among populations of small towns and small cities served by such supplies, cases of methemoglobinemia would have been discovered and reported. As yet, however, no cases of methemoglobinemia have been reported from a public water supply secured from wells or springs. With regard to public water supplies obtained from surface streams, water containing more than 5 p. p. m. of nitrate nitrogen is rarely encountered. A recent review of the experience in New York State from 1943 to 1946 indicates that of 1,517 samples from surface supplies only 2 contained 10 to 15 p. p. m. of nitrate nitrogen (27).

There is, however, a possible hazard created through the discharge of industrial wastes. This is illustrated by the experience of Warren, Ohio (26). Since the war, several plants, built originally for the production of trinitrotoluene, have been converted into plants producing ammonium nitrate for use as fertilizer. Wherever such plants are situated there is a possibility of direct contamination of surface waters. While no cases of methemoglobinemia have as yet been traced to such sources the potential hazard exists and the health authorities should be alerted to it.\*

\* The following recommendations are made toward minimizing and controlling waste water from plants producing ammonium nitrate for use as fertilizer: (a) Allow the operation of such plants only in areas where there is practically no danger of water supply contamination by the plant wastes. (b) Increase plant house-keeping efficiency to the highest level consistent with economical plant operation. Attention should be given to the conservation of plant products. This conservation should be practiced to eliminate nitrate waste discharge rather than to recover its value. Through recent efforts of the Army

## SUMMARY

Water supplies derived from springs and wells, whether public or private, which have a high nitrate nitrogen content are distributed over a much wider geographic area than are the cases of methemoglobinemia as yet reported. So far the cases have been associated only with the use of water from private household supplies of well water. These observations lead logically to a question of the nature of the factor or factors that are required in addition to high nitrate content in the causation of this condition and that are peculiar to the geographic area of its occurrence. The hypothesis might be advanced, for example, that causation is not determined alone by the age of the infant, the quantity of water ingested, and the concentration of nitrate nitrogen of the water used for dilution of the formula, but that there is a difference between nitrate nitrogen derived from organic and inorganic sources, or that it is necessary to have present some additional factor or factors derived from biologic activities in the soil or in the well water to insure the breakdown of nitrates into nitrites after ingestion by the infant. These and similar questions cannot yet be answered. There is urgent need for further study before comprehensive preventive measures can be advocated. Such a study would be facilitated if it were organized on a basis that would permit observations in various parts of the United States by the same unit. This unit should consist of an epidemiologist, a pediatrician, a sanitary engineer, a biochemist, and a bacteriologist, with the needed laboratory facilities. The problem is of sufficient importance to justify the interest of the Federal Government.

## CONCLUSIONS

1. Further studies should be made of the relation of the nitrate nitrogen content of well waters to methemoglobinemia in infants.
2. Pending such studies, health authorities in the States and Provinces concerned should be advised that water from private household

Footnote 3 continued

Industrial Hygiene Laboratory, the loss of material being processed from one such plant was reduced about 75 percent. This was accomplished by following good housekeeping techniques in handling the materials throughout the plant with increased respect from the standpoint of waste. (c) Maintain constant surveillance of such plants, their wastes and the effects of these wastes on surface and ground waters in the area through appropriate Federal and State agencies. Lagooning waste water from such plants is not an ultimate solution because of the danger of constant leaching of the nitrates into the soil and ground water. At present there appears to be no feasible treatment method for nitrate wastes. The only recognized possibility is the use of biologic ponds wherein the nitrates become food for plants that are in turn consumed by animal life. (d) Emphasize the importance of nitrite as well as nitrate nitrogen in these problems as the nitrite content may be responsible for methemoglobinemia. Dr. E. Polkman has prepared these findings in connection with studies being made for the Committee on Sanitary Engineering and Environment, National Research Council.



# Antibiotic Drugs in Venereal Disease Therapy

MICHAEL J. SCOTT, *Captain, U. S. A.*\*

**B**ECAUSE of the widespread use of antibiotic drugs, the number of patients sensitive to one or more of these agents is increasing. The desirability of having an alternative antibiotic drug for the sensitized patient is, therefore, becoming increasingly important. Although the optimum dosage and duration of therapy have not yet been standardized, numerous schedules with antibiotic drugs have been found to cure venereal diseases.

## GONORRHEA

The drugs of choice in the treatment of gonorrhreal urethritis are penicillin, aureomycin, streptomycin, and the sulfonamides. The dosage and results of sulfonamide and penicillin therapy are well known and need not be discussed. Aureomycin hydrochloride given orally in doses of 1 to 3.5 gm. over a period of 12 to 36 hours is highly effective against acute gonorrhreal urethritis. In a large series of cases (1) 92.6 percent of the patients were cured with a single course of treatment. The results are, therefore, inferior to those obtained with a single intramuscular dose of 300,000 units of crystalline penicillin in beeswax and peanut oil. In a small series of cases at this hospital we have not as yet encountered any failures in patients given a total of 3 gm. in doses of 0.5 to 1 gm. every 8 hours. The effects of aureomycin, given orally, on the clinical and bacteriologic findings are similar to those observed with penicillin although they occur more slowly. The urethral discharge generally becomes less profuse or ceases entirely within 24 hours. With this small dosage, toxic effects were not observed. Aureomycin is of value in patients sensitive to penicillin or in the so-called "penicillin-resistant" cases. Aureomycin in the dosage recommended, is also of value in treating gonorrhreal urethritis in patients with coexisting syphilis. With the small dose cited, aureomycin did not affect the darkfield examination or the sero-

\* 88th General Hospital, European Command, U. S. Army.

logic tests for syphilis in contrast to the effects of penicillin in the treatment of gonorrhea. Streptomycin is also effective in the treatment of gonorrhea. In a large series of cases (2) a single intramuscular injection of 0.3 to 0.6 gm. of streptomycin in an aqueous solution resulted in the cure of 90 percent of the patients. Patients failing to respond to this initial injection were reported as being cured by a second treatment with a slightly larger amount of streptomycin. Since streptomycin in such small doses does not inhibit the activity of the spirochete, it does not prevent the appearance of the early clinical manifestations nor does it prolong the incubation period of syphilis, as is the case with penicillin. Preliminary reports indicate that chloramphenicol will be effective in gonorrhreal urethritis.

#### LYMPHOGRANULOMA VENEREUM

The drugs of choice in lymphogranuloma venereum are aureomycin (3) and the sulfonamides. Numerous dosage schedules, including 20 mg. of aureomycin given intramuscularly every day for 10 consecutive days, have proved effective. Because severe local pain and toxic reactions often occur at the site of the injection, it is more practical to prescribe 0.5 gm. orally every 8 hours until the condition is cured. The usual dose of sulfathiazole or sulfadiazine is 1 gm. four times a day for 10 to 21 days or until the lesions heal.

#### CHANROID

The drugs of choice in the treatment of chanroid are aureomycin, the sulfonamides, and streptomycin. At this hospital, using aureomycin in doses of 0.25 to 0.5 gm. every 8 hours until the lesions were completely healed, the stay in the hospital was shortened, compared to the hospitalization formerly required with sulfonamides. Toxic effects have seldom been observed and discontinuance of the drug for that reason is usually not necessary. Sulfathiazole or sulfadiazine, having the advantage of lower cost, are generally prescribed in doses of 1 gm. four times a day until the condition is cured (usually 7 to 21 days). Streptomycin, although effective (4), is no more so than sulfathiazole and has the disadvantage of intramuscular injection. Streptomycin would be indicated in sulfonamide-sensitive patients in whom coexisting lesions of syphilis are believed to be present. Aureomycin, administered in sufficient quantity to cure chanroid, may prevent the appearance of the early clinical manifestations of syphilis or prolong the incubation period. It is, therefore, advisable to follow all patients receiving aureomycin with monthly serologic tests for syphilis on completion of therapy.

### GRANULOMA INGUINALE

The drugs of choice in granuloma inguinale are chloromycetin, aureomycin, and streptomycin. Chloromycetin, administered orally in doses of 0.5 gm. every 6 hours for 10 to 15 days until 20 to 30 gm. have been given, has proved effective in treating this disease (5). Donovan bodies disappear more rapidly from the lesions than when streptomycin or aureomyein are used. Healing occurs before the therapy is completed or 2 to 3 weeks following completion of therapy. Resistance to chloromycetin has, in contrast to streptomycin, not been encountered. The toxic effects of chloromycetin have been negligible. Although the recommended dosage of streptomycin is 4 gm. a day given intramuscularly in divided doses for 5 consecutive days, the author believes that this dosage is too large and prefers to give 1 gm. a day in divided doses for 15 to 20 days. About 10 percent of all patients treated with streptomycin eventually have a relapse (6). A few streptomycin-resistant patients have been reported. Aureomycin has proved effective in these patients and in those who relapse following treatment with streptomycin (7). It has, however, the disadvantage of occasionally causing nausea, vomiting, and diarrhea because of the relatively large total dose required and because of the longer duration of therapy in this disease.

### SYPHILIS

The drugs of choice in the treatment of syphilis are penicillin and aureomycin. Two treatment schedules for the treatment of primary, secondary, and latent syphilis are recommended: (a) penicillin G in aqueous solution administered every 3 hours, night and day, for 8 consecutive days and using a total of 4,800,000 units; or (b) crystalline penicillin G in peanut oil and beeswax (or procaine penicillin in oil), given in 10 consecutive daily injections of 600,000 units each. At present the latter schedule is being used in the Army. The failure rate varies in different clinics, but is probably less than 10 percent when reinfections are considered. Treatment with penicillin alone in early syphilis is as satisfactory as when combined with arsenic and bismuth preparations. The recommended total dose in congenital syphilis varies between 100,000 and 400,000 units per kilogram of body weight, given in divided doses for 8 days. In the treatment of neurosyphilis a total of 9,000,000 to 15,000,000 units in divided doses for 15 to 21 days is recommended. This may be in either an aqueous solution or in a peanut oil and beeswax base. The Army prescribed 96 consecutive intramuscular injections of 100,000 units each of aqueous penicillin G, given every 3 hours for 12 days. Numerous experiments are in progress in which procaine penicillin in oil with aluminum mono-

steatate is being used. In one such experiment 1,200,000 units are being given in a single intramuscular dose for the treatment of primary and secondary syphilis. The results with this method have been promising.

Aureomycin, although not as effective as penicillin, has been used successfully in the treatment of syphilis (8) (9). Following either oral or intramuscular administration it is readily absorbed into the blood stream and is capable of diffusing through the placenta. Unlike penicillin, aureomycin has been demonstrated in the spinal fluid. The changes in the cerebrospinal fluid findings have been similar after either aureomycin or penicillin therapy. Herxheimer reactions are commonly noted in syphilitic patients receiving aureomycin and this phenomenon should be remembered whenever an unexplained rise in temperature occurs following the administration of aureomycin. The Herxheimer reaction may be observed 24 to 36 hours after initiating therapy. Aureomycin appears, therefore, to have the widest range of any known antibiotic drug in the treatment of venereal diseases.

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# Early Detection of Carcinoma of Cervix Uteri

SARKIS S. SARKISIAN, Lieutenant (MC) U. S. N.<sup>1</sup>

THE cytologic study of smears of the cervix uteri for the detection of cancer has proved to be of undeniable value. The Departments of Pathology and of Gynecology, U. S. Naval Hospital, San Diego, Calif., have undertaken a joint study to evaluate the accuracy and practicability of the smear technique for cancer detection as advocated by Papanicolaou and Trant (1). This report is an evaluation of the results obtained with this technique in the detection of malignancy of the cervix uteri.

## MATERIALS AND METHODS

Preliminary tests were made in an attempt to evaluate various cell staining methods. The stains compared were the hematoxylin-eosin, Hortega's silver stain, and the Papanicolaou-Trant stain (1) (2). The technique of procuring the smear was standardized by utilizing the cervical surface method as described by Ayre (3) (4). This was modified in that a standard tongue blade was cut down to conform more readily to the cervical os; by rotary movement, the wooden blade procured cervical material. This was smeared on a slide and immediately immersed in a solution of equal parts of 95 percent ethanol and ethyl ether. After a minimum of 15 minutes of fixation, the slide was air dried and sent to the laboratory. Three slides were prepared for each case.

Smears of the first 200 cases were stained by the three staining methods referred to previously and examined for cytologic evidence of malignancy. Thus a comparative series of cases were studied for staining efficacy. It was found that the cells characteristic of cancer could be detected by Hortega's silver stain, "H and E," or Papanicolaou's method. However, the cellular detail was superior with the latter two stains. It was also noted that more information relative to hormonal effects on the desquamated cervical and vaginal epi-

<sup>1</sup> U. S. Naval Hospital, San Diego, Calif.

thelium was obtained with the Papamcolaou stain technique. Therefore, it was decided that the Papanicolaou method was the technique to be used in the remainder of the study.

Schiller's iodine tinctorial test of the cervix was used in the first 500 cases of the series and no correlation of this test and malignant areas of the cervix was found. This procedure was discontinued in the remainder of this project.

#### FINDINGS AND RESULTS

To date, 1,500 smears have been studied and of these 29 showed cytologic evidence of carcinoma of the cervix. Twenty-two were confirmed by biopsy, and in 7 biopsy of the cervix was negative. Thus the percentage of confirmed positive reports was 1.5 percent and the percentage of false positive reports was 0.47 percent. Meigs et al. (6) reported a series of 1,015 cases, with carcinoma found in 154 cases and a false positive report of 8.1 percent. Kano (6) reported a series of 500 cases with 1.6 percent false positives. Keinodle et al. (7) reported 1,700 cases in which cancer was found in 124 and a false positive report of 8.1 percent. Thus the results at this hospital compare favorably with those reported in the literature. It must be pointed out, however, that in our series the 7 false positive cases were reported in the first 250 cases examined indicating that with increasing experience in interpretation of smears, the number of errors became smaller. The number of false negatives cannot be determined unless a specimen for biopsy is taken on all patients. It is evident that such a procedure in a large series is not feasible. No attempt to select patients was made; all patients that presented themselves at the out-patient department were given a "cancer" test.

Definitive therapy is dependent upon whether the cervical lesion is preinvasive or invasive carcinoma. This is determined by obtaining a 360° cone of the cervix by sharp dissection. The specimen is serially sectioned and the ecto-endocervical junction is especially examined since this is the critical area as the nidus of malignancy according to Foote and Stewart (8) and Pund and Auerbach (9). If the cone reveals the neoplasm to be preinvasive, a simple hysterectomy with resection of a wide vaginal cuff is done. The distal 2.5 cm. of the cervix uteri is serially sectioned to rule out invasive carcinoma. On the other hand, if the initial cervical cone reveals invasive carcinoma, radium and high-voltage roentgen therapy is instituted as outlined by Baker (10).

Smears of the cervix of patients being treated for invasive carcinoma are taken weekly to determine the radiosensitivity of the tumor. Radiation response can be made on histologic studies as reported by Frankl and Antreich (11), Arneson and Stewart (12),

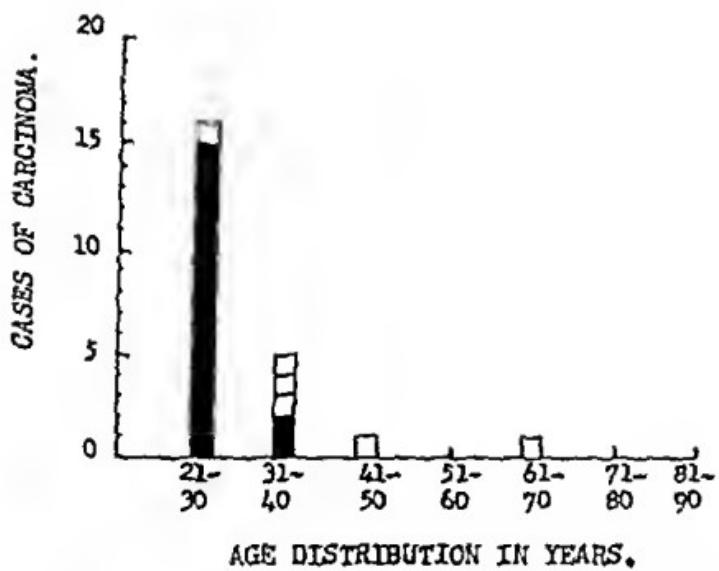


Figure 1.—White area represents the number of cases of invasive carcinoma; black area represents preinvasive carcinoma.

of the uterus. In this instance even after biopsy it was difficult to determine whether it was anaplastic adenocarcinoma or a squamous cell carcinoma. However, the cervical smear revealed cells with a definite keratinized cytoplasm indicating that the tumor was an anaplastic squamous cell carcinoma.

#### COMMENT

Sufficient data have been accumulated to indicate the value of the Papanicolaou-Trant cervical smear technique in determining when a specimen should be removed for biopsy. It should be emphasized that the smear is to be used only as an adjunct in establishing a diagnosis of cancer and that a diagnosis of carcinoma must be made only after biopsy. It is true that in some cases, the smear is quite specific in establishing a diagnosis of malignancy, still the source of error in borderline cases makes it imperative that biopsy be done. On the other hand, there were four cases in this series in which smears were positive for evidence of cancer and were negative on biopsy of three consecutive "around-the-clock" specimens. Finally, when a 360-degree conization of the cervix was done, the carcinoma was found. The value of smear screening methods cannot be overemphasized.

The importance of early diagnosis cannot be overemphasized. Cullen (16) in 1921 stated: "It is to the early diagnosis of cancer of the cervix that we must look for future success." At this hospital during the 6-year period from 1942 through 1948, a total of 44 cases of squamous cell carcinoma of the cervix were reported with 4 cases of *in situ* or preinvasive carcinoma. In contrast, during the 9-month period from October 1948 through June 1949, 27 cases of squamous cell carcinoma were detected by smear technique and proved by biopsy. Of these, 22 cases were preinvasive and 5 cases were invasive carcinoma. Statistics emphasize the value of the Papanicolaou-Trant method for the early detection of carcinoma of the cervix uteri.

#### CONCLUSIONS

The cervical smear technique as introduced by Papanicolaou-Trant is of definite value in the diagnosis of early carcinoma of the cervix.

Biopsy of "around-the-clock" specimens of the cervix is not the final procedure in the detection of malignancy. A more accurate method is the serial section of a 360-degree conization of the cervix. In some instances this removes all histologically demonstrable carcinoma.

Cytologic studies are valuable in following radiation response and determining radiosensitivity of the malignant lesion of the cervix.

The Papanicolaou-Trant smear technique should be adopted in properly staffed hospitals as a screening method for the detection of carcinoma of the uterus.

Cytologic study of a smear of the cervix for detection of malignancy should be done on all women at least once a year.

Schiller's tinctorial test of the cervix is valueless in localizing areas of early cancer of the cervix.

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# Combination Porcelain and Acrylic Jacket

By JOHN V. SCHAFFER, D.D.S., M.S.

SEVERAL types of jacket crowns are being made today and all of them are useful in crown and bridge procedures. One that is an excellent replacement for single anterior teeth when an acrylic jacket crown is inadequate is being made in some dental laboratories. A crown that will meet the standards of good restorative dentistry can be made with a combination of porcelain and acrylic.

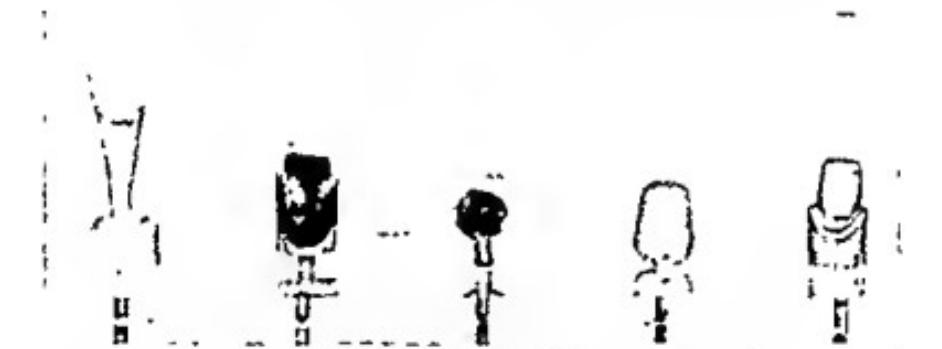
A porcelain jacket crown preparation with a definite shoulder on the apical periphery is made on the tooth to be treated. An impression is taken and an anatomical die is made. Two cores are duplicated in stone and articulated with the anatomical die in the same occlusal relationship. A platinum matrix 0.01 inch in thickness is attached to the anatomical die in the same manner as for a porcelain jacket. The entire matrix is covered with about 1/2 inch of dampened porcelain of the same shade as that of the acrylic to be used. The energy-activated barrier with damp porcelain is allowed to dry and is then placed in the porcelain furnace and given a low incineration. The time and temperature of these porcelain bakes are governed by the type of material used. The semi-fused porcelain is removed from the furnace and porcelain is added especially to the shoulder area to maintain the shoulder that has occurred. It is then placed in the furnace and given a high incineration. If an over-shade occurs it can be removed with informational disks or stones. A roughened surface will be more adherent to acrylic material when the matrix is processed with porcelain.

An anatomical core can be used for this procedure also although a manufactured acrylic tooth such as D.L. 200-200 is preferred. When a manufactured acrylic tooth is used it is cut in half laterally and adapted to the initial surface of the porcelain core. Care is exercised the fit and contact areas is necessary in this stage. After it is well adapted to the porcelain core the initial surface is traced to the maximum internal form for the tooth to be treated. The excess cores is removed from the die and it then ready for processing. The

jacket crown is invested in stone with the lingual waxed surface exposed to the upper half of the flask. After the wax has been removed by boiling water, the required shade of acrylic is packed onto the tooth and the porcelain-acrylic jacket is cured by conventional standards for curing methyl methacrylates. The most important step here is to cool the flask to room temperature *slowly* before deflasking. Rapid cooling by plunging in cold water will fracture the porcelain core. By carefully removing the crown and trimming judiciously little finishing is necessary (figs. 1 and 2). A brilliant gloss is not required as fluids in the patient's mouth will give a natural appearance to the crown. Sometimes a second matrix of mesh platinum is plated over the initial



*Figure 1—Front view from left to right. Amalgam die, porcelain core, acrylic facing, waxed-up combination, finished jacket.*



*Figure 2—Rear view from left to right. Finished crown, lingual waxed surface, acrylic facing, porcelain core, amalgam die.*

matrix of platinum and the porcelain is baked onto it. This provides added strength but is not essential to the technique.

This combination jacket is especially valuable in that it (*a*) can absorb great stress because of the external layer of acrylic, (*b*) has an excellent watertight gingival seal, (*c*) unites with most cementing mediums, (*d*) can be altered externally, and (*e*) is excellent for the average shell crown.

# Malacoplakia of the Urinary Bladder

## Report of a Case

CHARLES E. BOONSTRA, Lieutenant, junior grade (MC) U. S. N.<sup>1</sup>  
PHILLIPS L. BATES, Lieutenant, junior grade (MC) U. S. N.<sup>1</sup>

MALACOPLAKIA is a rare lesion of the urinary bladder first described by Michaelis and Gutmann in 1903, and later named by von Hansemann in 1906 (1). In 1913, McDonald and Sewell (2) reviewed 21 previously reported cases and described 1 case of their own. In their case, lesions were found in the urinary bladder and both kidneys at autopsy. Only occasional cases have been reported since then, bringing the total to approximately 50.

### CASE REPORT

Mrs. W., age 25 years, was first seen in the out-patient clinic in October 1947. At that time she was in the fourth month of her second pregnancy. She complained of gross, painless, intermittent hematuria. There was a history of three previous episodes of gross hematuria that occurred in 1944, 1945, and 1946. (In 1946 she was in the seventh month of her first pregnancy.) The hematuria lasted less than 1 week and each attack of bleeding was associated with urinary tract infection.

On admission in October 1947 the physical examination was essentially negative except for the urinary tract. On cystoscopic examination the bladder appeared normal, but blood issued from the right ureteral orifice. The urine contained numerous red and white blood cells. Urograms revealed a bizarre architecture of the calyces bilaterally, a possible filling defect on the right side, and a 1.5 cm. renal calculus on the left. The urinary tract infection and a moderate anemia, which had developed secondarily to the ureteral bleeding, responded to routine therapy, and she was discharged, symptomatically relieved.

She was readmitted 3 months later, having had hematuria daily since her discharge from the hospital. The findings were similar to those of the first admission. Routine symptomatic treatment was again given, and arrangements were made to terminate the pregnancy as soon as possible and still obtain a viable infant. In February 1948, during the eighth month of pregnancy, a living infant was delivered by cesarean section. The hematuria subsided and the patient made an uneventful recovery.

<sup>1</sup> Department of Pathology, U. S. Naval Medical School, and the Department of Genitourinary Surgery, U. S. Naval Hospital, National Naval Medical Center, Bethesda, Md.

In April 1949, she was treated for a left pyelonephritis. Hematuria had been present for 4 days. The symptoms and hematuria then subsided for a period of 11 months. A calycectomy was performed with removal of a calculus from the left kidney.

Hematuria returned for the seventh time in February 1949, and she was readmitted for further study. Significant physical findings were weakness and pallor and a 2-month uterine pregnancy. Laboratory findings: The red blood cell count was 3,700,000; hemoglobin, 10 gm (69 percent). The urine contained numerous red blood cells, no organisms were noted on smear.

On cystoscopic examination bloody urine was noted. The bladder mucosa showed generalized inflammation and bullous edema at the vesical neck. There were two solid, yellowish-brown, moundlike elevations of the bladder mucosa, each measuring 0.5 cm in diameter; one was located anteriorly and laterally to the right ureteral orifice, the other behind the trigone and medial to the right orifice. Blood issued from the right ureteral orifice. Urograms were essentially unchanged from previous studies. PPD Iberenulin tests were negative.

Biopsy of a specimen of one of the bladder lesions showed granulation tissue and large numbers of macrophages containing laminated spherical, basophilic bodies pathognomonic of malacoplakia. There was infiltration by moderate numbers of plasma cells, a few lymphocytes, and occasional polymorphonuclear leukocytes. Interstitial tissue was scanty except for a rare fibroblast and a few capillaries. The overlying epithelium was denuded. Biopsy of a second specimen showed essentially the same findings. In addition, however, there was squamous metaplasia of the overlying bladder epithelium. Acid-fast stains were negative for *Mycobacterium tuberculosis*. Attempts to find the basophilic bodies in the urinary sediment from the right ureter and from the bladder were unsuccessful.

The patient received five blood transfusions but continued to bleed. Because of the apparent correlation of the hematuria with pregnancy and also because of the refractory anemia, a therapeutic abortion was recommended and accepted by the patient.

Hematuria continued following this procedure. A phenolsulfonphthalein test, done 8 days postoperatively during cystoscopy, showed the following. The right kidney excreted 10 cc of urine in 10 minutes with 17 percent total dye concentration, the left kidney, 12 cc in 10 minutes with 7.5 percent total concentration. The appearance time was 3 minutes from each side.

The right renal pelvis was lavaged with 5 cc of 1 percent silver nitrate solution. Twelve days after the abortion and four days following treatment with silver nitrate, the urine became grossly clear.

Since the patient's discharge from this hospital, she has had one recurrence of hematuria.

#### DISCUSSION

**Etiology.**—Many authors of earlier articles concerning malacoplakia attempted to indict *Mycobacterium tuberculosis* as the etiologic agent, inasmuch as in many of their cases pulmonary tuberculosis was found at autopsy. However, the presence of *Myco. tuberculosis* in the lesions was never demonstrated.

Many of the cases reported were associated with an *Escherichia coli* infection of the urinary tract, but again no one has proved a definite etiologic relationship between this organism and malacoplakia.

Rudnick and Ragsin (3) reported a case of malacoplakia of the bladder occurring in the presence of severe urinary tract infection associated with unilateral nephrolithiasis. Upon removal of the diseased kidney, the infection and malacoplakia regressed spontaneously. Urine cultures revealed *Proteus vulgaris*, *Esch. coli*, *Staphylococcus albus*, and *Klebsiella pneumoniae*.

Cases have also been recorded in which hematuria was the only symptom.

The occurrence of malacoplakia in such a variety of circumstances suggests that it is a response to nonspecific irritation of the urinary bladder. If such is the case, malacoplakia probably is often not recognized.

Redewill (1) reported a case of malacoplakia in a patient with concurrent lesions of Boeck's sarcoid. He believed that the pathologic findings in both conditions were strikingly similar and concluded that malacoplakia is the manifestation of sarcoid in the urinary bladder. We believe that this is an erroneous assumption. Histologically, the lesions of Boeck's sarcoid are composed of small tuberclelike structures composed of whorls of epithelioid cells with Langhans-type giant cells. Occasionally these giant cells contain an intracytoplasmic inclusion body of calcific material and asteroid bodies. This calcific inclusion body is coarsely laminated, deeply basophilic and irregular in outline, roughly spherical, and has been named the Schumann-Boeck body. The main cellular constituents of lesions of malacoplakia, although resembling epithelioid cells as described by some authors, are macrophages and are not arranged in tubercle fashion. Also, when multinucleated cells exist, they do not assume the appearance of the Langhans giant cell. The intracytoplasmic bodies diagnostic of malacoplakia are highly characteristic, and differ morphologically from the Schumann-Boeck body and the asteroid body.

**Pathology.**—As described by most writers, the lesions of malacoplakia grossly are soft, small, rounded nodules, usually only a few millimeters in diameter and slightly elevated above the surrounding mucosa. They vary from pale yellow to gray, frequently have a slightly umbilicated pale center, and are often surrounded by a hyperemic halo. There may be only a few such nodules or they may be quite numerous. Occasionally, several small lesions coalesce to form a single large yellowish-white plaque which may be several centimeters in diameter (6). The most common sites are the posterior wall, the

region of the trigone, and about the ureteral orifices Morison (4) reported a case in which a large nodule caused obstruction at the vesical neck. The lesions have also been found in the ureters (4) and in the kidneys (2).

The microscopic features are diagnostic and consist of varying numbers of highly refractile, homogeneous or laminated, spherical, basophilic bodies, the so-called Michaelis-Gutmann bodies (figs. 1 and 2). In our case these were numerous and varied considerably in size, some of the larger measuring 12 to 15 microns in diameter, the smaller 2 to 3 microns. Occasionally bulblike forms have been reported. Their presence has led several observers to conclude erroneously that they are fungi. Apparently, their main constituent is calcium although small quantities of iron are also present (3). For this reason they have also been called calcospherites. They are usually present, singly or in pairs, intracellularly, although a few are apparently extracellular (2). In contradistinction to the Schaumann-Boeck bodies the calcospherites are finely laminated, moderately basophilic, smooth of outline, and perfectly spherical. Also, asteroid bodies, which are rather frequent in lesions of sarcoid, are not found in malacoplakia.



Figure 1.—Michaelis-Gutmann bodies within macrophages. Plasma cell infiltrate.

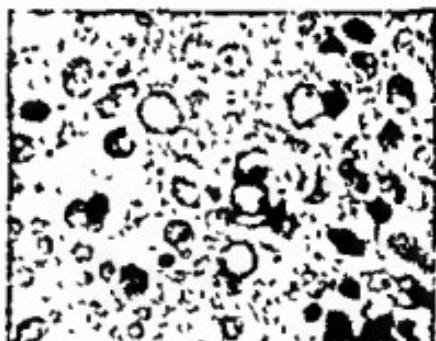


Figure 2.—High-power view showing detail of Michaelis-Gutmann bodies.

In most reported cases the macrophages which contain the calcospherites are the predominant cell type in the lesion. They are quite large, round, oval, or polygonal. Their cytoplasm is pale, eosinophilic, homogeneous, or finely granular. The nuclei may be vesicular, but are usually hyperchromic and somewhat irregular.

In areas where the macrophages are most numerous there is a scanty stroma of reticulum fibers which separates the cells into small islands (3). At the periphery of the nodules numerous fibroblasts are usually present together with an increase in the amount of stroma. Peripherally and at the bases of the lesions are usually numerous endothelial-lined, thin-walled, blood channels.

Symptoms referable to urinary tract infection have been prominent in the majority of patients. Occasionally asymptomatic gross hematuria has been the chief complaint (1) (5), as it was in our case.

Malacoplakia occurs most frequently in women of middle age or older; however, several cases have occurred in younger persons. Morison (4) reported a case in a 6-year-old girl; Oppermann (7) reported a case in an 8-year-old girl and referred to a case in a 9-year-old girl, previously reported by Fraenkel.

#### TREATMENT

Because of the infrequent recognition of the disease process no standardized treatment has been formulated. The lesions have responded to local fulguration in most cases. In Redewill's (1) case the patient's hematuria subsided upon irrigation of the renal pelvis with weak silver nitrate solution. Again, another case spontaneously regressed merely upon removal of a source of infection in one of the kidneys (3).

#### SUMMARY

A case of malacoplakia of the urinary bladder is reported in a 25-year-old white woman whose principal symptom was intermittent, painless, gross hematuria, usually associated with urinary tract infection.

Although hematuria occurred between pregnancies, it became more profuse and constant during pregnancy. This is an interesting but unexplained feature of this case.

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# Circumcision in the Adult

JUDSON A. MILLSPAUGH, *Commander (MC) U. S. N.<sup>1</sup>*

DURING the past 3 years more than 350 circumcisions were performed on the urologic service at the United States Naval Hospital, Pensacola, Fla. The ages of the patients varied from early childhood to the fifth decade, but the majority were in their twenties. More than 150 of them had early syphilis. Circumcision was done usually on the third day of penicillin treatment for syphilis, at which time the darkfield examination is invariably negative for *Treponema pallidum*. Healing was uneventful and the patients were ready for discharge upon completion of standard treatment— $7\frac{1}{2}$  days (6 million units of penicillin) in seronegative patients, and 10 days (8 million units of penicillin) in seropositive patients. Incidentally, among the last 400 patients admitted for syphilis, only 5 had been circumcised. Circumcision was done in three patients in whom a clinical diagnosis of syphilis was postulated but the diagnosis was not confirmed by repeated darkfield examinations and serologic tests. However, histologic examination of the excised prepuce was consistent with a diagnosis of syphilis in two and the third showed nonspecific chronic inflammation. Subsequent follow-up revealed a strong seropositive reaction in the first two patients; the third had a seronegative reaction. Penicillin treatment was only initiated following laboratory confirmation. The circumcisions healed by primary intention in all three patients.

Since over 150 circumcisions of patients with early syphilis have healed primarily, we conclude that early syphilis under treatment with penicillin is no contraindication to simple elective operation, and that circumcision serves several useful purposes: (a) Hygiene is improved for the patient; (b) increased resistance to syphilitic reinfection and malignancy are enhanced; (c) no additional time is lost in hospitalization; and (d) the operation is good teaching material for interns, all of whom should have experience in this simple, valuable operation which, in many cases, is definitely indicated, particularly in the military service.

<sup>1</sup> U. S. Naval Hospital, Pensacola, Fla.



# Ainhum

## Report of a Case With Bilateral Involvement

PAUL B. BENDER, *Lieutenant, junior grade (MC) U. S. N.<sup>1</sup>*

**A**INHUM or dactylolysis spontanea is a disease of unknown cause characterized by a progressive constricting fibrous band at the base of one of the digits, usually the little toe, with eventual spontaneous amputation of the involved digit. It is confined almost entirely to the Negro race, is uncommon in the United States, but it is frequently encountered in tropical countries. As a rule, only one toe is involved. The fingers are rarely affected.

The disease begins with the formation of a transverse groove in the skin on the flexor surface of the toe at the digitoplantar fold. The groove deepens and spreads circumferentially until the toe is completely surrounded by a narrow fibrous band.

The distal segment becomes enlarged, soft, and bulbous, and atrophy of the nail occurs. Pain is usually absent; however, ulceration may supervene with developing gangrene and pain. There is resorption of the underlying bone until the toe is attached only by a fibrous cord (4) (6) (9) (13) (14). Spontaneous amputation occurs several years after the initial lesion.

Microscopically there is hyperkeratosis, scar tissue formation, and low-grade chronic inflammation. Many of the vessels exhibit an endarteritis, although the significance of this finding has been previously overemphasized (5). The underlying corium is thin and merges with the periosteum so that each can barely be differentiated. A rarefying osteitis is found in the involved bone.

Ainhum has been considered by various authorities as a distinct pathologic entity and by others as a manifestation of a more generalized condition. It has been found in several nonlocalized diseases of the skin. Hyde and Montgomery (19) and Spencer (7) observed it in conjunction with palmar and plantar keratoses. Stelwagon (17) found it associated with pityriasis rubra pilaris. It has also been reported in patients having ichthyosis, scleroderma, and keratodermia.

<sup>1</sup>U. S. Naval Hospital, Charleston, S. C.

tended to the underlying bone. The phalanx was narrow, irregular, and measured 0.3 cm at its smallest diameter.

On microscopic examination a nonspecific fibrosis was observed. At the constricting band the epidermis was thin and showed a complete loss of rete pegs. Hyperkeratosis and parakeratosis were distinct at the site of constriction; although on either side of the band there was absence of parakeratosis. The underlying corium consisted of dense collagenous connective tissue that merged into the periosteum and contained a few diffusely scattered lymphocytes. Ret pegs, sudoriferous glands, and accumulations of lymphocytes were present on either side of the constricted area. In the area of scar tissue formation only capillaries were visible. Some of the adjacent arterioles showed slight endarteritis but the majority appeared normal. The underlying phalanx was irregular and showed osteolytic changes with partial replacement by collagenous tissue. Fat cells filled the trabecular spaces. No inflammatory reaction involving the phalanx could be demonstrated.

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TABLE I—Results

Sex	Age	Distribution	Pain at onset of treatment	Duration of disease or to onset of treatment (days)	Number of injections of local anesthetic drugs	Results	Observations
						Initial	Final
M	28	L 1-2	Moderate	6	4	Pain gone in 48 hours. Vertigo with headache in 4 days.	
M	21	L 1-2	Severe	5	4	Pain completely relieved in 4 days.	
M	21	T 7	Moderate	3	4	Pain gone in 72 hours.	
M	49	T 2-3	Severe	15	15	Poor relief of pain.	
M	77	T 3	Moderate	7	7	Relief of pain after 4 days.	
M	77	20 T 12 L 1	Severe	6	4	No pain after 72 hours.	
M	77	20 T 6	Moderate	3	3	No pain after second injection.	
M	77	20 T 5	Severe	5	4	Adjusted complete relief in 18 hours.	
M	77	20 T 7-8	Moderate	6	4	Pain decreased greatly in 24 hours.	
M	77	20 T 1-3	Severe	7	7	Six days of pain, then complete relief.	
M	77	T 2-3	Moderate	1	1	Changed in 2 days.	
M	62	T 7-8	do.	10	22	Improved after 10 days.	Pain gone in 22 days.
M	42	T 5	Moderate	3	1	Initial relief of pain.	
M	29	L 1-2	Moderate	10	1	No pain after 3 injections.	
M	29	T 6-7	Mild	3	1	No pain after 2 injections.	
M	29	T 5	Moderate	15	15	Pain lessened after 4 days.	
M	29	L 1-2	do.	6	6	Pain relieved in 3 days.	
M	37	T 7-8	Moderate	4	3	Excellent results.	
M	38	T 2-3	Severe	6	8	Pain improved after 3 injections and was gone after 6 injections.	
M	22	T 5	Moderate	2	1	Excellent results.	
M	32	L 1-2	Mild	6	5	Pain gone for fixed 5 days of treatment.	
M	24	T 2-3	Severe	10	5	Pain raised within 48 hours.	
M	26	T 5	Moderate	3	3	Excellent results.	
M	22	T 6-7	Severe	8	4	Pain relief results.	
M	23	T 1-2	Severe	6	6	Pain relieved in 72 hours.	
M	31	T 5	Moderate	4	4	No pain after 2 days.	
M	32	T 6-7	Severe	7	7	Pain relieved in 48 hours.	
M	37	T 2-3	Severe	10	5	Good results with extensive involvement and severe pain.	
M	22	T 5	Moderate	4	4	Good results.	
M	22	CN 6	Severe	10	8	Pain relieved in 10 days, gone in 22 days.	No evidence of structural impairment.
M	22	C 2-3	Mild	4	3	Pain relieved in 3 days.	

Four inguinal nodes remained tender 1 day s. Previous skin rashes with pituitrin w/ full improvement. New vesicles after first injection. Skin lesions rapidly increased and healed. Treatment with act. jelly lie solid and rapidly prior to probable without relif. Skin lesions flat w/ rapidity. Thrombocytopenia rapidly for 44 hours. Skin is shown to wind rapidly. Hemorrhagic bundle healed w/ only superficial scarring.

None. Pain during first 2 days equated true of morphine tolerance like "p" and headache on admis. on. Bath started in 48 hours. Severe pain initially w/ dose of 200 mg. At least 100 mg. of morphine w/ dose of 200 mg. Vascular fistula not overnight. Original fistula is older for 6 days.

None. Name \_\_\_\_\_ skin lesions hemorrhagic. Probably continue until they flat & heal completely.

None. Large, tender natalary nodes.

None. Name \_\_\_\_\_ Case was treated outside as a contact dermatitis before being started on protocol. None. Name \_\_\_\_\_ Large axillary glands probably ventributed to the severe pain. None. Name \_\_\_\_\_ Patient stated he had "shingles" to face last time took 2 weeks to heal. Some. Name \_\_\_\_\_ Severe left costochondral tenderness, chronic atherosclerotic disease solution. None.

## CONCLUSIONS

While this series of cases is small and clinical evaluation of the relief of pain in this disease difficult, it is believed that protamide is of definite value in the relief of pain in herpes zoster. Further vesicles and crusts disappear much more rapidly than in untreated cases.

The relief of pain was superior to that obtained when using either pituitrin, thiamine chloride, autohemotherapy, sodium iodide, or high-voltage roentgen therapy.

The advantages of protamide are the simplicity and absence of pain in administration, lack of reactions, and its apparent safety.

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ies made during and immediately subsequent to the recent war (2). It has long been considered that these tendencies were indicative of the individual's inability to perform adequately in the Armed Forces. This study, however, revealed little significant difference between the three groups. Of those traits customarily classified as conversion manifestations (with the exception of the complaint of headaches), the probation violator was not exceptional. The two better adjusted groups consistently totaled a higher percent of anxiety manifestations than the probation violator (fig. 4).

## DISCUSSION

It was hoped that by comparing the probation violators with two other groups, certain identifying characteristics could be noted in the preservice environment of the individual which would enable psychiatric examiners at induction centers to predict the potential offender. This study succeeded partially; however, no single factor stands out. This group shows certain tendencies which are strongly suggestive for classifying certain individuals as potential general court martial offenders.

*Physical condition.*—Physically the probation violator is in sound condition. He was considered to have been a nervous child.

*Home background*.—Such factors as size of family, lineal position in the family, and age of parents at birth of child vary so slightly among the three groups that their positive diagnostic value is doubtful. Of greater importance is the broken home situation, whether it is due to death, separation, or divorce, and the age at which the break occurred. Health of the parents and health of the subject's wife are important. Of greater significance than the fact that the parents were unable to get along with one another is the fact that the probation violator was unable to get along with his parents. This indicates an unpleasant home situation. Unsatisfactory foster homes appear frequently in the background of the probation violator. Punishment, when it engenders a feeling of persecution or rejection and the solution of his problems by flight, increases the probability of the inadequate solutions by these persons to problems in service life.

*Socioeconomic background*.—Evidence supporting the principle that a bad community necessarily produces delinquency has only weak support. Poor financial status or poverty occurred in a large number of homes from which the probation violators came. This individual is not unusual in the matter of truancy or in having frequently been committed to a reform school, but he differs significantly in having been committed to jail or civilian correctional institutions. Probation violators consistently get into trouble because of overindulgence in alcohol.

*Marital.*—The probation violator is willing to "try" marriage at a relatively early age; consequently, he exhibits a higher separation and divorce rate than the others.

*Educational background.*—Mentally, the probation violator is dull and inadequate. Repeated failures in school through inaptitude, resentment, and poor ability to adjust are apparent.

*Self-evaluation.*—The probation violator tends to overestimate himself in terms of his actual performance.

*Early neurotic traits.*—There was no significant difference among the three groups in regard to the manifestation of early neurotic traits.

#### PROFILE OF THE PROBATION VIOLATOR

The probation violator in his childhood showed evidence of his later personality traits by revealing, at an early age, his reaction to his poorly adjusted parents who were apt to have ill health based on poorly defined disorders, probably neurotic in origin. Their marital adjustments were unsatisfactory, and the events leading up to the disruption of the home (usually prior to his sixteenth birthday) produced in him a feeling of resentment and rebellion which were reflected in his later conduct. Poverty, and frequent shifting of home and interest, contributed early to the development of insecurity and a tendency to seek the pleasure of the moment because of the uncertainty of the future. This hedonistic need began to lead to minor delinquencies which earned for him the title of "black sheep." The early disruption of the family resulted in his placement in various "homes" which further contributed to his insecurity and inadequacy. His own lack of respect for authority, fostered by the poor example of his parents, the severity of the punishment they inflicted for minor breaches of discipline, the poor example set by his relatives, many of whom came in conflict with the law, and his own search for the "easy way," brought him into early and not infrequent conflict with the police.

He early demonstrated a tendency to seek flight as a solution to his conflicts. He was frequently truant when school became difficult, and left usually after several failures. He ran away from home if his parents became demanding. When physical flight became impossible because the conflict was within himself, he escaped by means of alcohol which further contributed to his difficulties because a false sense of well-being and superiority fostered by the alcohol made him belligerent and brought him into further conflict with authority. He frequently sought escape into marriage, but here found little comfort and as a consequence was divorced and remarried but not living in harmony with his second wife. Finding no satisfaction in his pur-

suits, having no education for higher skilled tasks, he eventually entered the military service where his pattern of flight continued.

### CONCLUSIONS

It must be admitted frankly that this study has fallen short of its original objective. It is believed, however, that sufficient value lies in the general psychologic profile of the probation violator to warrant its publication.

The lack of success is attributed in part to the following causes:

(a) The intrinsic difficulty of establishing such criteria.  
(b) The lack of a control group in the true sense of the word. Such a group should have consisted of men who had successfully completed a period of probation subsequent to a general court martial and confinement. Due to administrative difficulties such a group was not available at this time.

(c) The tendency on the part of the general court-martial prisoner to conceal or evade questions relative to his past experiences, with the desire to appear as "no worse than the others," may have decreased the area of difference in many cases.

(d) No set of characteristics in which the probation violator was consistently high and the other groups correspondingly low was isolated. It is, therefore, suggested that a substantial constellation of these elements should appear in the experience and personality of the individual before he is discarded as a potential recidivist.

Much work must yet be done by the psychologist and the psychiatrist in this problem of probation violation, as well as in the problem of eliminating the original general court-martial offender. This study is presented in the hope that where we have succeeded others may take up the lead and follow through to a more successful conclusion and that others may profit by our mistakes.

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# Current Trends in Medical Education<sup>1</sup>

MELVIN A. CASHERG, M.D.<sup>2</sup>

WE ARE just rounding out the first 50 years of the twentieth century, an era of medical progress unequalled during any similar period in history. Medical education has played a vital part in this achievement. Because medical textbooks often become obsolete even before the printer's ink is dry, and medical students begin their formal education from 5 to 10 years before they engage in the practice of their profession, medical educators are faced with a serious problem. A therapeutic solution taught in school today is not necessarily valid when an identical situation presents itself to the graduate 5 years later. Medical education, therefore, must work with a flexible curriculum molded to meet the demands of the present and to anticipate future trends. Faced with an ever-changing scientific order where that which was strange yesterday becomes commonplace today, and that which is commonplace today becomes antiquated tomorrow, medical education cannot rest on its laurels but must show continued progress or fail in its purpose. Constant, directed adjustment of subject material and a frequent reapportionment of time to subjects taught is vital to educational growth. Thus the mucosal ulcerations of typhoid fever must be assigned a respectful niche in the hall of medical curiosities, while cancerous ulceration of the intestine is placed under the investigative floodlight. The long periods of time spent in teaching the pathologic changes of red and gray hepatization of lobar pneumonia must be diverted to the study of degenerative heart disease.

Medical sciences are reverting to the basic sciences. The curtain of inaccessibility that surrounded the unexplored hinterland of medicine is being pushed back by discoveries in the basic fields. Operations are more successful today not because of improvement in the technical surgical skills, but rather because of a more thorough knowledge of

<sup>1</sup>Presented at the monthly Medical Meeting, Army Medical Center, Washington D. C., 18 May 1950.

<sup>2</sup>Dean, St. Louis University School of Medicine, St. Louis, Mo.

the intricacies of preoperative and postoperative care which are fundamental contributions of biochemistry. Regions of the body once inaccessible to the surgeon have been rendered accessible by advances in anesthesiology, which in turn is little more than applied physiology and pharmacology. The greatest single recent contribution to the therapeutic armamentarium of the physician—penicillin—came from the laboratories of basic science.

As the knowledge of medicine became more extensive there developed in medical practice the trend toward specialization. This tendency continued to the extent that as each new facet of a specialty was brought to light the process of fission gave rise to another until the number of subspecialties became legion. The movement is by no means new for, in the year 1854, at a meeting of the American Medical Association a resolution was introduced concerning the problem of specialization. A survey of medical students will reveal that about 50 percent of them wish to be specialists and this is not surprising in view of the fact that all who control undergraduate and graduate medical education are specialists. If this selectivity continues the organization of the medical profession will eventually become unbalanced. If 80 percent of the conditions bringing a patient to a physician can be handled adequately by a general practitioner then, in the interests of conservation of manpower and man-hours, we as medical educators are wasting a large portion of our time.

There has been evident, especially since the close of the last war, a rather bitter resentment on the part of the general practitioner against the favored lot of the specialist. Undoubtedly there is just cause for a certain amount of this, and the belief of the general practitioner that unfair discrimination exists has welded together a vigorous and vociferous Academy of General Practice. Medical educators are vitally interested in what path the medical profession will follow. Some would have us believe that eventually all physicians will be specialists and the future pattern of medical practice will be that of group clinics. They argue that lines of rural communication are improving and rural hospitals are springing up all over the country, hence this system will work in both rural and metropolitan communities. It is difficult to understand the logic of this reasoning, for such a plan of education and practice would result in a tremendous waste of time and personnel. Why train every physician to a specialty level when only 20 percent of man's ills require specialist care? The medical trainee as it is must follow an arduous, time-consuming course of studies before he "arrives" and it is doubtful that the lengthening of this training period would stimulate the enthusiasm of medical aspirants. Furthermore, human nature being what it is, one might predict that once a profession composed entirely of specialists had

been established there would arise a hierarchy of superspecialists. I believe that the general practitioner, in an improved version, is a permanent fixture on the American scene.

The latest statistics released by the American Medical Association reveal that there are now 200,000 physicians in the United States, one for every 750 people. This is the highest ratio of any nation in the world with the exception of the newly founded state of Israel where a higher proportion of physicians exists as a result of the great exodus of Jewish physicians from Europe. Social planners would have us believe that a real dearth of physicians not only faces us now but that the situation will continue to deteriorate unless schools of medicine greatly increase their numbers of graduates. Before accepting such a statement there are several factors to be considered. As certain procedures incorporated in the art of medicine became standardized they were turned over to subprofessional personnel. The early radiologists, for example, took their own roentgenograms, developed them, interpreted them, and followed the whole procedure from beginning to end. Such a situation does not exist today for the technician has assumed the responsibility for two-thirds of this procedure. By this transformation physicians have been freed from countless technical details and have more time available for direct patient care. There is no reason to believe that this trend will decrease.

Medical discoveries such as the antibiotics have led to the control of most acute infectious diseases and vast amounts of time have been released to physicians. Recently, I made rounds on the wards of a large municipal hospital that I had not visited since the completion of my internship and surgical residency about 10 years ago. The outstanding impression I carried away was the scarcity of patients with acute inflammatory diseases. Beds that 10 years ago were occupied by patients with lobar pneumonia, acute mastoiditis, and cellulitis of the extremities were used for other purposes. Is it illogical to assume that in another 50 years the proper physician to patient ratio might not be 1:1000?

During the first half of the twentieth century life expectancy in the United States has increased by about 20 years. Since 1900, although our population had doubled, the number of persons over 65 years of age has quadrupled. The age shift carries with it profound medical, social, and economic implications. Geriatrics will soon be no less important than pediatrics.

Man has created war weapons capable of delivering devastating blows into the very heart of the remotest enemy territory which means that, in the next war, civilian casualties will probably approxi-

mate or even outnumber military casualties. It was well demonstrated in the past world war that the successful handling of casualties from areas of catastrophic damage depended on organization. A skilled surgical team is of little value if the injured cannot be brought in for care. This organization for catastrophe should be of vital concern to medical educators. No medical student, whether he plans to practice in a rural or a metropolitan community, whether he anticipates service as a military surgeon or not, should be permitted to graduate without some basic training in this problem of mass casualties. The medical R. O. T. C. is bearing the brunt of this educational program at present and well it should, for the Medical Corps of the Army is well qualified to instruct in this organizational problem. Lest these words be taken as the superficial compliments of a guest speaker to his hosts, I should like to add that Saint Louis University School of Medicine has, by over 100, the highest R. O. T. C. enrollment of any medical school in this country. Such interest is readily obtainable if the students realize that the medical school administration stands behind the professor of military science and tactics.

There has been criticism both by certain of the curricular-hour-conscious faculty and time-pressed students but, on careful explanation of the program, I have been able to impart to these critics my feelings of deep responsibility and obligation in this time of international tension for the indoctrination of every medical student with basic information regarding planning for catastrophe. In my opinion the inculcation of military medical organization in students of medicine will, in the event of a national disaster, result in the saving of thousands of lives.

Graduate professional training given in the Army hospitals since the last war has been of a high order. It is distinctly to the advantage of medical education that military medicine stands at the highest level of professional and administrative skill since its inception. Furthermore, the close liaison between the military and civilian medical professions is of utmost importance in these days of international unrest. My only fear at the moment is that false economy might inadvertently destroy the results of these years of coordinated labor on the part of military and civilian physicians alike. In the not impossible event of war, it would be a tragedy to find an emasculated Medical Service! My experience in the past war convinced me of the inestimable morale-building value of a well-coordinated, smooth-functioning medical service. In the face of possible future mass destruction of the civil population dare we trifle with the structure of military medicine when its units must form the nucleus on which civilian medicine will depend for organization? Civilian morale in any future war may well determine victory or defeat.

The last two decades have witnessed a renaissance of certain social movements in the United States which may have an important effect on the future of the medical profession. Basically two sections of our population have brought about this resurgence of social consciousness, namely the labor unions and the farmers. These elements have exerted a great political pressure on our country and there is no reason to believe that this will decrease. Medical leaders of today must appreciate these trends in public thinking and demonstrate their readiness to assume the leadership in the solution of social problems. Medical schools in great part have failed to educate students as to their social responsibilities. In an effort to remain within the bounds of pure science, educators have shunned this problem, and this neglect is largely responsible for the serious socioeconomic crisis now faced by the medical profession. We take great pride in developing a student who is capable of making a most difficult diagnosis and yet suffer few if any pangs of remorse as this brilliant young physician demonstrates an utter ignorance of his social responsibilities to his patients.

#### PREMEDICAL PREPARATION

There is no standard premedical curriculum nor, indeed, should there be one. The Council on Medical Education and Hospitals of the American Medical Association and the Association of American Medical Colleges have prescribed basic minimal requirements for entrance into medical school but beyond these prerequisites no further curricular advice is submitted. Schools of medicine differ somewhat in their admission regulations but most academic bulletins include fairly standard minimal quantitative, qualitative, and subject requirements. The combined credit hours of the premedical subjects, however, do not comprise half of the total required for college graduation. Thus wide latitude is presented in the choice of elective studies. Professional scientific education has become so time-consuming in terms of years of preparation that there has developed in educational philosophy, a trend in the direction of pruning off all curricular activities not directly related to acquiring a degree. This is unfortunate for, while it is usually accepted that the studies pursued in the undergraduate years must have some relationship to the subject matter of the medical curriculum, a broad educational foundation is indispensable to the development of a well-rounded physician. It is important that the applicant to the school of medicine shall have acquired that culture which has been traditionally associated with the Bachelor of Arts degree.

Dr. Rappleye, Dean of the Faculty of Medicine at Columbia University, in a recent paper<sup>2</sup> writes that "college preparation for medi-

<sup>2</sup> Read at the Thirtieth Annual Meeting of the National Health Council, 24 March 1950.

cal, dental, and public health fields should not be preprofessional in character" and that "education is not 'pre' anything, but should be devoted to the objective of providing as broad a cultural education as the institution can provide." The lack of sound cultural education has led to a state of affairs where the technologies have far outstripped our social and spiritual structure. Man splits the atom and then cowers in fear lest this scientific monster turn and destroy its creator. Dr Allen, president of the University of Washington, has aptly stated that well-rounded development of character and personality are "qualities never lacking in good physicians and without them intellectual development, however brilliant, is socially useless and possibly dangerous." \* In the selection of medical students scholastic achievements cannot be substituted for excellence in character. The school of medicine carries deep responsibility in ascertaining insofar as possible the capability of the applicant to use the knowledge and skill to be acquired through medical education in a manner beneficial both to society and to himself.

There is no such thing as a typical premedical student and medicine rather than being a single career is actually a multiplicity of careers. Although the art and science of medicine may embrace the philosopher as well as the technician, the recluse as well as the extrovert, the poet as well as the statistician, each applicant to the school of medicine should present substantial evidence that he or she has mastered the basic fundamentals of chemistry, physics, and biology, and furthermore that this mastery will continue into the period of formal professional training. Now that we appreciate the acceptable qualifications of an applicant, our greatest problem is that of determining whether he has these qualities. How can we as members of an admissions committee be sure that a proper blending of the necessary academic and character ingredients exists? The transcripts of grades and admission tests present certain alphabetical and numerical ratings that give a more or less comfortable assurance as to the applicant's intelligence, but how does one determine character? Letters of recommendation are of value only insofar as the testator's objectivity is reliable. I maintain that without much difficulty a graduate of Sing Sing could obtain letters of recommendation that would present him in a favorable light as a candidate for a divinity school.

Numerous papers have been written on the methods of interview best suited to determine qualifications for admission to a school of medicine. Some prefer the "solo" interrogation system in series so that the applicant is never outnumbered in this battle of wits. Others still prefer the "police court" system where the would-be physician

\* Medical Education and the Changing Order

faces a battery of interrogators. I doubt the real contribution of this method of evaluation. How many of our medical leaders of today would receive high scores on an interview basis? Certainly, actual contact reveals information as to dress, speech, and mannerisms but can this be interpreted in the light of future success or failure in medicine? We may question at length the applicant's motivation in his desire to study medicine but how can we be assured that the answers are fundamentally honest? I do not wish to imply that character recommendations and personal interviews should be dispensed with in the selection of medical students, but rather to caution lest too important a role be assigned these adjuncts of the admission committee. Frankly, those who might be best qualified to judge admissibility are not the faculty of medical schools, but rather the premedical faculty, who have had opportunity to follow these aspirants through 3 or 4 years of preparation. A close liaison between the medical and premedical faculty may be of inestimable value in the problem of proper selections. In view of the fact that the ultimate choice of the men and women who will become the future physicians of America rests solely in the hands of admission committees of the medical schools, it is the responsibility of these committee members to consider their roles with deep seriousness.

#### THE PRECLINICAL CURRICULUM

Strict departmentalism presents a barrier to the correlation of the medical school curriculum both horizontally between contemporary subjects and vertically between the preclinical and clinical years. A medical faculty which appreciates that its prime responsibility lies in teaching the science of medicine and not the science of biochemistry or physiology is wise indeed. To each department head his subject is the cornerstone of medicine and a dean must practice all the wiles of diplomacy in order to balance the intellectual budget of curriculum hours. Through the past 50 years various basic departments have attracted the spotlight of attention, beginning with anatomy and continuing to the present with biochemistry now standing in the center of the preclinical stage. The lack of horizontal correlation between subjects taught concurrently results in a great loss of time, integration, and cohesion. One technique of color picture printing involves the serial superimposition of three or four basic colors in the formation of the finished product. Any one basic print, if studied alone, would give an inadequate idea of the final scene, and yet this is the system too often used in preclinical instruction. How inefficient to study the structure of the stomach in the anatomy laboratory and then at a different time and place restudy the muscular functions of this same organ in

physiology and again the secretory functions in biochemistry. By combining the study of structure and function not only is precious time saved, but even more important the final picture is correlated, clear, and complete.

Departmental boundaries shift with time and place. Who is to determine where the dividing line between biochemistry and physiology lies? Will the lectures on digestive secretions fall to the lot of the biochemist or the physiologist? The exact point of division is of little significance and a partial erasure of departmental lines with closer correlation in the teaching program is desirable. The correlation must, however, be intelligently supervised lest certain subjects be covered more than once and the others not at all. The shortness of the time the student is exposed to these courses makes it imperative that the faculty select their instruction material carefully.

Too often the first 2 years of medical education present the student with a mass of facts far in excess of that which he can retain, until the poor bewildered recipient of this deluge of instruction vainly struggles to remember faster than he forgets. Some medical wit has said that the difference between a freshman and a sophomore student is that when the professor says, "Good morning," to the first-year class they reply in like manner verbally, but when the second-year class is thus greeted they promptly write it down in their notebooks. There is grave danger in a curriculum which is so overwhelming in its factual presentation that it tends to create memory experts and destroys the investigative scientific initiative of the student. Furthermore, medical educators in the basic sciences must beware lest they develop a philosophy among their students that the printed scientific word is final. The effects of such distorted thinking become evident in the laboratory when the student's prime interest lies in the attempt to direct the results of his experiments to conform with those of the textbook.

Every preclinical student should have available the time and facilities to stimulate his curiosity and originality. The administration of a medical school should make it possible for a student who so desires to spend an additional year or two in research in one of the basic sciences. Saint Louis University School of Medicine has established assistantships encouraging the medical student to participate in such a program. A vertical correlation of the preclinical and clinical curriculum is of value in emphasizing the importance of certain rather prosaic courses. For example, in discussing the various tracts of the spinal cord in neuroanatomy, the Department of Neurosurgery might well demonstrate a postoperative chordotomy in which the spinothalamic tracts have been sectioned; or during the dissection of the

inguinal region on the cadaver the presentation of various types of inguinal hernias will serve to enliven the interest of the student in his partially dissected corpse lying in its academic shroud. Whereas a certain amount of clinical information might well be given the pre-clinical student, I cannot consider it good pedagogy to expose the freshmen and sophomores to advanced clinical subjects for which they do not have the proper foundation. Such instruction leads to incorrect interpretation and faulty habits of deduction. Enthusiasts who prematurely would release students to advanced clinical courses with the explanation that they must learn to reason and correlate for themselves are acting on a false premise.

Next year at Saint Louis University School of Medicine the academic session will be broken into three periods of 13, 10, and 10 weeks in order that the Christmas and Easter vacations might fall at the close of a period. Thus major examinations are completed before the vacations and the student goes home to relax rather than to wear himself out cramming for semester tests. Frankly the incentive for this change came from my memory of the severe mental conflicts during Christmas vacations in reference to the question to study or not to study.

#### THE CLINICAL CURRICULUM

Until recent years, the preclinical departments have, with some relief, turned the third-year medical students over to the clinical faculty and then have forgotten about them. Current trends in medical education stress the necessity for close correlation between the preclinical and clinical curriculum. The biochemist should participate in discussions of preoperative and postoperative fluid balance just as should the physiologist contribute to the general presentation at a clinical pathologic conference on renal failure. The value of such correlation lies not only on the better instruction of the student but also in the stimulation of mutual interest on the part of clinician and basic scientist alike in a clearer understanding of their common problems.

Long hours of classroom lectures have been replaced by clinical clerkships. This is good pedagogy. I remember very little of my classroom lecture on the catatonic phase of schizophrenia but indelibly recorded in my memory is the schizophrenic girl with masklike features who held her arm fixed in any position to which the psychiatrist moved it. Instruction in the presence of the patient for small groups of students permits a teacher-pupil intimacy that cannot be reproduced in the classroom. The pendulum of clinical medical education is swinging even further than small group instruction and on to the preceptorial method of teaching. This system has been held in high esteem since the earliest historic period and was the accepted vehicle

for training physicians until late in the last century. I have given serious consideration to the advantages of the preceptor system and have inaugurated a student apprenticeship this year that has acted as a pilot test for future application.

One of the important values of a preceptorial form of instruction is the development of a better appreciation of the fine art of physician-patient relationship. Just how does one approach Mrs. Smith to inform her that she must have her breast removed because of a malignant growth? The student may give a scholarly discussion on the diagnostic interpretations of a bleeding nipple or the fine points of microscopic differentiation between a scirrhoue carcinoma and an intracystic papillary adenocarcinoma, but at the same time may be ineffectual and callous in his attempts to discuss the situation in simple practical terms with the patient. Such intimate teaching methods require an increased faculty. The use of younger instructors is the solution to this problem. I have been most satisfied with the high caliber of teaching and the degree of enthusiasm demonstrated by the recent graduates from residency training. Because of their recent educational exposures these younger men and women are in a position to differentiate between good and poor methods of instruction. Furthermore, they have more time to donate than do their older colleagues. Medical schools have not been sufficiently aware of the unlimited teaching talent existing in their recently graduated physicians.

A horizontal correlation of contemporary subjects is just as important in the clinical as in the preclinical years. Much of our instruction stimulates the student to think in terms of departmental boundaries, and this is a serious pedagogic error. Too frequently the junior and senior student on the surgical ward thinks only in terms of surgical diseases and then of psychosomatic conditions alone while on the psychiatry service. We cannot afford as medical educators to forget that the subject matter of interest to the student should be the patient as a whole rather than any artificial subdivision of the patient formulated to suit the convenience of a hospital or a school of medicine. In keeping with this concept, Saint Louis University School of Medicine in conjunction with The University Hospital has established a pediatric heart clinic planned along the lines of a functional unit. This clinic falls under the jurisdiction of neither the department of medicine nor of pediatrics. It is staffed by a functional team of a pediatrician trained in child heart diagnosis, a radiologist familiar with the diagnostic problems of pediatric heart disease, a pathologist experienced in congenital cardiac anomalies, and a surgeon trained in congenital cardiovascular surgery. These men are erasing the boundaries of departmentalism and students are being influenced to think in terms of whole functional units.

A well-staffed, smooth-working university hospital might well be the envy of the medical profession and yet because of its very efficiency there may be certain educational shortcomings in that a student in his clinical years on the hospital wards may gain a distorted notion as to the relative frequency and importance of disease entities. An instructor finds that it is easy to interest his students with a discussion on a rare malady. Thus uncommon and difficult cases become the daily fare. Unless the teacher makes an effort to evaluate the relative frequency of diseases the student will graduate without appreciating the fact that patients partially disabled by chronic or minor illnesses, who are not admitted to hospitals, make up a large percent of those who are sick. I must confess that following my training in surgery, whereas a gastric resection presented no serious problem there were certain minor surgical conditions that strained my ingenuity simply because, during my residency, I had not had the opportunity to become familiar with them.

The clinical student must appreciate that hospital pajamas are a great equalizer of men. The bank president and the bank clerk may look exactly alike removed from their environmental background. Their symptoms may be identical and their ulcers may look alike under the fluoroscope. Since, the one might easily afford a trip around the world to ease his nerves, while the other possibly could not obtain the funds for a trip to the nearest pleasure resort, ideally the student should be given opportunities to follow the study of his patients into their home environments.

Although space does not permit a discussion of internships and residencies, medical schools are interested in this phase of graduate training. One cannot draw a line between the senior medical student and the intern and state that there is any basic difference in the educational formula to which these students should be exposed. There is actually much less instructional difference between the senior medical student and the intern than there is between the preclinical sophomore and clinical junior years of medical school. Ideally the postgraduate hospital training should be under the direct supervision of the school of medicine. There is a definite trend toward "straight" internships and some believe that the "rotating" internship will soon be a thing of the past. I do not consider the "straight" type of service an internship but rather feel that it is a first year in a specialty residency program. This trend is of great importance to schools of medicine in that the type of training afforded by "rotating" internships must be made available to the student prior to graduation. In other words the junior and senior students will be acting in the capacity of interns and the intern year must of necessity be absorbed into the undergraduate clinical curriculum.

The successful practice of medicine entails a dual progression, namely, progress in the art as well as in the science of medicine. In order that the art might flourish it is necessary for the physician constantly to return and refresh himself by dipping generously into the ever-progressing river of science. The voodoo witch doctor practices an art of healing but his failure lies in the lack of coordination with the science of healing. We shall fail as educators unless the student is imbued with an insatiable desire to continue studying throughout his professional career. The ceremonial function for the granting of a diploma is well termed, the Commencement, for, to the true physician, this is but the initiation of a never-ending process of medical education.



# Coordination of Administrative and Professional Effort in Army Hospitals<sup>1</sup>

WARNER F. BOWERS, *Colonel, MC, U. S. A.*<sup>2</sup>

**A**LTHOUGH the average hospital operates as though there were an unbridgeable gap between administrative and professional functions, actually they overlap. The necessary coordination and cooperation are founded on mutual respect, understanding of the problems of each, and, above all, a common goal, namely, optimal patient care. Please etch on your memory the fact that were it not for patients, there would be no need for physicians; and were it not for physicians, there would be no need for nurses or for the ancillary corps. This point is too often forgotten by Medical Service Corps officers, nurses, and physicians. Let me emphasize the importance of the middle word in the name of one ancillary corps—service. The connotation of this word has been known to physicians and nurses for centuries but is relatively unfamiliar to the nonmedical assistants who, in ever increasing numbers, are becoming concerned with the care of the sick and injured. Wider realization of the benefits of service to others with its broadest implications, would be of the utmost assistance to the country as a whole in these times of arrant self-seeking.

The sooner we realize that all those who work in the hospital are part of a team striving for a common end, the sooner shall we attain the goal of optimal patient care. Patients are querulous, uncertain, and insecure because of their illness, its strangeness to them, the uncertainties of the outcome, and the unfamiliar hospital surroundings. What is a daily routine to you and of no particular moment may be of great seriousness to a patient. Consequently, patients need more than average consideration and sympathetic handling. This, of course, does not mean coddling, overprotection, or encouragement of self-pity. Nor does it mean that convalescent patients should be treated like

<sup>1</sup>Presented to class of Medical Service Corps and Women's Medical Specialist Corps officers taking the Improved Management Methods Course at Valley Forge General Hospital.

<sup>2</sup>April 1950

<sup>3</sup>Office of the Surgeon General, Department of the Army.

sick patients. Convalescent patients must be made to feel that duty is preferable to remaining in the hospital and this requires an entirely different method of handling. Nurses will tell you that patients who have been very ill cannot understand the apparent change in the attitude of nurses and physicians as they get well. Such patients often feel abused until an explanation is given.

Most of the patients' contacts in the hospital are with persons other than the physicians. Patients themselves do not realize the necessity for this and often complain that they rarely see a physician. Patients take medical care for granted and the other contacts are the ones longest remembered. Patients remember the food and general atmosphere rather than treatment received. Since these are the facts, it is essential that we make every member of the team aware of the importance of nonmedical contacts. To visitors, the most important person in the hospital often is the enlisted man at the information desk or switchboard. To the patient, the most important contacts are with enlisted man, nurse, and physician in the receiving room. It takes a lot of later favorable impressions to counteract the first unfavorable reaction to lying on a stretcher for a long period in the receiving room waiting for someone to do something.

You probably feel that after the course you have received, you fully appreciate the implications of what I have said. When I read a preliminary draft of this paper to interested officers in our office, I was told that I was talking about ancient history and that all was now changed. However, having had some experience as a reactionary, I feel that this is a little optimistic. I wish it were that easy to change what has been accepted for years. This will become readily apparent at your first duty assignment when you will discover that it will take a continual struggle to put across the new ideas you have been taught; anything new accepted only with great difficulty. If you believe that our hospitals are run for the benefit of sick patients the following questions are still pertinent. For whose benefit do we arouse patients at 0330 hours? Few well people arise at that hour and I cannot be convinced that it is beneficial for the sick. For whose benefit do we serve the evening meal at 1630 hours? What well person eats dinner at such an hour? This simply forces patients to stuff themselves later at a snack bar or get into trouble by raiding the ward-kitchen icebox. For whose benefit are supplies neatly stacked on shelves in locked warehouses? Many instances can be quoted in which professional services submit requests or make complaints about nonavailability of needed items which have been in their own medical supply warehouse all the time. Medical supply officers should urge chiefs of service to go through the warehouses periodically or perhaps distribute lists of

newly acquired items at suitable intervals. For whose benefit do we keep patients in hospitals for days or weeks after they are fit for duty while some clerk shuffles the papers, writes for a service record that could have been procured weeks earlier, or does many things that could be done just as well after the patient has left the hospital? In none of these and many other instances can it truthfully be said that we are basing our system on the best interests of the patient.

Mutual respect and cooperation depend largely on the feeling that the other person knows his job and is doing it well. This feeling can be only incompletely present unless we know what he is supposed to be doing and why. This point cannot be stressed enough. Physicians especially are guilty of failing to understand the necessity for what they consider red tape. Why are three copies of certain correspondence necessary? Because three separate offices must maintain a record file. Why must the supply officer have a written request? Because he must have something to show why, when, and to whom he made issue. Why must the clinical records be complete and accurate? Because they frequently become evidence in legal or administrative procedures, even years later. Why must the registrar be notified of the decision to discharge a patient as soon as the physician can make up his mind? Because records must be obtained from elsewhere, orders must be issued, and other time-consuming procedures are necessary. I have always found it advisable to explain these matters in detail to officers on a professional service, repeatedly and at regularly scheduled conferences. Conversely, I have always found it advantageous for all officers, administrative and professional, to attend the regular staff meetings in which professional matters are discussed. This necessitates a little extra work to insure that what is said is clear to all present, but the increased mutual understanding justifies the added effort. Many times when you do not get along well with another person and have a developing feeling of antipathy, it is because you do not know him well enough and are not acquainted sufficiently with his problems and aims; this is particularly true with groups of people such as those in the various hospital services. If you are not getting along well with those in another service in the hospital, it is possible that you are at fault because of a narrow outlook or insufficient understanding of the problems involved. Learn all about the other services, their aims and problems before passing judgment or commenting unfavorably on them.

One other problem has become a cause for serious alarm both in the service and in civil life; I refer to the current tendency to avoid work. Everyone has to have an executive assistant to do the work. Physicians no longer want to take care of patients but simply issue

the old policy where officers in many of the specialties could receive D prefix 6 months after residency training. Likewise, officers without formal training will now require, for all specialties, 18 months of duty limited to the professional field instead of the 12 months formerly required for many specialties. One exception to this criterion is the award of certain secondary sub-specialty classifications to officers already qualified as A, B, or C internists or surgeons.

Group C prefix will now be awarded only to officers who have recently completed the formal training required to meet the American Board requirements for certification; whereas, in the past officers have been awarded a C prefix after completion of 2 years' residency training. This will mean that now an officer will not receive his C prefix until after completion of 3 years of formal training in the major specialties. Likewise, officers without the formal training required must have professional duty or practice limited to the professional field for a minimum of 5 years for all specialties prior to the award of C prefix. In the past this required period has varied from 3 to 5, 4 to 6, or 5 to 9 years, depending on the specialty involved. Again exceptions are made in regard to the award of a C prefix in secondary subspecialties for officers already qualified as A, B, and C internists or surgeons.

Group B prefix, in the future, will indicate that the officer has been certified by the American Specialty Board for his particular classification. Officers who have been awarded the B prefix without a board certification will continue to retain this prefix designation as long as their performance of duty indicates continued ability to function in the specialty without professional supervision.

Group X.—For the first time a new prefix appears in the medical officer classification policy. This prefix is an indication that the officer to whom it is awarded has qualifications in research that are associated with the specialty field identified by his MOS. The need for some specific designation of officers qualified or trained in research has been recognized by this office for a considerable period. An attempt has been made to establish a specific MOS for this type of officer but technical difficulties and other problems have precluded such an MOS being established. In lieu thereof, the Surgeon General's Office was authorized to use the prefix system to designate an officer qualified or engaged in research. This has been done now by the establishment of the prefix X.

The new classification policy also defines for the first time the prefix designation identifying the degree of proficiency for the Radiological Defense Officer (3044). Although the same prefixes X, A, B, C, and D are authorized in connection with this MOS, the definition and

criteria under which these prefixes are awarded are quite different from those used in connection with other professional MOS's. This difference must be kept in mind when considering the qualifications and degree of experience of medical officers with MOS 3904.

Medical Officer, General Duty (3100) is a basic MOS. It indicates that an officer is qualified to perform various medical functions in a hospital, dispensary, field unit, or other military installation, rather than being limited to one particular field. In addition, it is used to designate the primary classification of officers assigned to duty as interns in either civilian or military hospitals. The alphabetical prefix denoting the degree of proficiency will not be used in connection with MOS 3100.

It is believed that this new change in policy will result in a more efficient classification and utilization of medical officers.



**CLINICAL USES OF INTRAVENOUS PRINCIPAL**, by David J. Granbank, M.D., Assistant Visiting Surgeon, Cumberland Hospital, Assistant Visiting Orthopedist, Kingston Avenue Hospital, Brooklyn, N.Y.; formerly Assistant Surgeon, Reconstruction Hospital Unit, New York Post-Graduate Medical School and Hospital, N.Y., and Milton C. Peterson, M.D., Visiting Anesthesiologist, Research Hospital, Kansas City, Mo., formerly Anesthesiologist, New York Post-Graduate Medical School and Hospital, Associate Professor of Anesthesia New York Post Graduate Medical School, N.Y. Publication Number 73, American Lecture Series, 104 pages, illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1950. Price \$2.25.

**THE MERCK MANUAL of Diagnosis and Therapy, a Source of Ready Reference for the Physician** 8th edition 1592 pages. Merck & Co., Inc., Rahway, N.J., publishers, 1950 Price \$5

**LIGHT THERAPY** by Richard Kozeski, M.D., Professor of Physical Medicine, New York Polytechnic Medical School and Hospital Publication Number 57, American Lecture Series 112 pages, illustrated Charles C Thomas Publisher, Springfield, Ill., 1950 Price \$2.25

**THE DIAGNOSIS OF SALMONELLA TYPES**, by F. Kauffmann, M.D., Chief, International Salmonella Center, State Serum Institute, Copenhagen, Denmark Publication Number 62 American Lecture Series 86 pages Charles C Thomas Publisher, Springfield, Ill., 1950 Price \$2.25

**MODERN PRACTICE IN DERMATOLOGY** edited by G. B. Mitchell-Hedges, O.B.F.M.D., F.R.C.P. Physician in Charge Skin Department, St. Mary's Hospital and Medical School, London Physician, St. John's Hospital for Diseases of the Skin and Institute of Dermatology University of London, Member Advisory Panel on Dermatitis, Ministry of Labor and National Service 836 pages illustrated Paul B. Hoeber, Inc., New York, N.Y., publisher 1950 Price \$12.50

**MEDICAL DIAGNOSIS Applied Physical Diagnosis** edited by Rosebe L. Dulien, M.D., F.A.C.P. Professor of Graduate Medicine Director of the Division of Graduate Medicine, and Vice Dean of the School of Medicine Tulane University of Louisiana; Senior Visiting Physician Charity Hospital of Louisiana at New Orleans Consultant in Medicine, Veterans' Administration Hospital, New Orleans, La. Consultant to the Surgeon General Department of the Army, Washington, D.C. 2d edition 1119 pages, illustrated with 601 figures 4<sup>1</sup>/<sub>2</sub> in color W.B. Saunders Co. Philadelphia, Pa., publishers, 1950 Price \$12.50

**CLINICAL ELECTROCARDIOGRAPHY**, by Francis P. Rosenbaum, M.D., Assistant Clinical Professor of Medicine, Marquette University School of Medicine, St. Paul, Milwaukee County Hospital, Associate Staff, Columbia Hospital, Adjunct Staff Milwaukee Children's Hospital, Cardiac Consultant and Attendant, Cardiac Clinic, Milwaukee Children's Hospital Milwaukee Wis. Edited by Henry A. Christian, A.M., M.D., LL.D. Sc.D. (Hon.) M.A.C.P. Hon. F.R.C.P. (Can.) D.B.M. (A.M.A.) Hersey Professor of the Theory and Practice of Physician Emeritus, Harvard University. Sometime Clinical Professor of Medicine, Tufts College Medical School, Sometime Visiting Physician Beth Israel Hospital, Sometime Physician in Chief, Farney Hospital Physician in Chief Emeritus, Peter Bent Brigham Hospital, Boston, Mass. (Reprinted from Oxford Loose-Leaf Medicine with the same page numbers as in that work) 205 pages, illustrated Oxford University Press, New York, N.Y., publisher 1950 Price \$1.50

**MODERN TRENDS IN ORTHOPAEDICS**, edited by Sir Harry Platt, M.C., M.S., F.R.C.S., Professor of Orthopaedic Surgery, University of Manchester, Consultant Adviser in Orthopaedics to the Ministry of Health President Societe Internationale de Chirurgie Orthopedique et de Traumatologie 495 pages, illustrated. Paul B. Hoeber Inc., New York, N.Y., publisher 1950 Price \$25

**NUTRITION AND DIET THERAPY**, by Fairfax T. Proodfit formerly Instructor in Nutrition and Diet Therapy, University of Tennessee College of Medicine and Tennessee School of Nursing, Director of Dietery Department, John Gaston Hospital, Memphis Tenn. and Coetzeine Holden Robinson Lecturer in Nutrition and Dietetics, Temple University School of Medicine, Philadelphia formerly Instructor in Nutrition and Diet Therapy, Columbia University School of Nursing 10th edition 930 pages illustrated. The Macmillan Co., New York, N.Y., publishers, 1950 Price \$4

**THE PHARMACOPEIA OF THE UNITED STATES OF AMERICA** (The United States Pharmacopeia), Fourteenth Revision (U. S. P. XIV) and The First U. S. National Formulary. By authority of the United States Pharmacopoeial Convention meeting at Washington, D. C., May 14 and 15, 1940. Prepared by the Board of Revision and Published by the Board of Trustees. Official from November 1950. 1066 pages. Mack Publishing Company, Easton, Pa., publishers. Price \$9.

**MARRIAGE IS WHAT YOU MAKE IT**, by Paul Popenoe, Sc. D., General Director, The American Institute of Family Relations, Los Angeles, Calif. 221 pages. The Macmillan Company, New York, N. Y., publishers, 1950. Price \$3.

**THE CEREBRAL CORTEX OF MAN, A Clinical Study of Localization of Function**, by Wilder Penfield, C. M. G., M. D. (Johns Hopkins), B. Sc., and D. Sc. (Oxon), Hon. F. R. C. S. (Lond.), F. R. S., Professor of Neurology and Neurosurgery, McGill University; Director, Montreal Neurological Institute, and Theodore Rasmussen, M. D., Professor of Neurological Surgery, The University of Chicago, formerly Lecturer in Neurosurgery, McGill University, Assistant Surgeon, Montreal Neurological Institute. 248 pages, Illustrated. The Macmillan Co., New York, N. Y., publishers, 1950. Price \$6.50.

**MANAGEMENT OF PERIPHERAL ARTERIAL DISEASES**, by Sami S. Samuels, A. M., M. D., Chief of the Department of Arterial Diseases, Stayner Polyclinic Hospital, New York, Consulting Vascular Surgeon, Long Beach Hospital, Long Beach, N. Y., Director and Attending Angiologist, Brooklyn Hebrew Home and Hospital for Aged, Brooklyn, N. Y.; Fellow in Surgery, New York Academy of Medicine; Member of Committee on Surgery, New York Diabetes Association. Editor-in-Chief, "Angiology". President, Angiology Research Foundation. 345 pages; Illustrated. Revised and enlarged from *The Diagnosis and Treatment of Diseases of the Peripheral Arteries*. Oxford University Press, New York, N. Y., publishers, 1950. Price \$7.50.

**MEDICAL PARASITOLOGY**, for Medical Students and Practicing Physicians, by William G. Skalitz, M. D., Associate Professor of Parasitology, Associate in Medicine, The Jefferson Medical College of Philadelphia; Special Consultant, U. S. Public Health Service, Communicable Disease Center, Atlanta, Ga. 246 pages; Illustrated. The Blakiston Co., Philadelphia, Pa., publishers, 1950. Price \$4.25.

**ORAL AND FACIAL CANCER**, by Bernard O. Sarnat, M. D., F. A. C. S., Professor and Head of the Department of Oral and Maxillofacial Surgery, College of Dentistry, and Clinical Assistant Professor of Surgery, College of Medicine and Research and Education, Chairman, Department of Oral and Facial Surgery, Editorial Board, Chairman, Board of Councillors, and Associate Dean in Charge of Postgraduate Studies, University of Illinois College of Dentistry, Chicago, with a foreword by Andrew C. Ivy, Ph. D., M. D., D. Sc., Vice President in Charge of Chicago Professional Colleges, University of Illinois, Executive Director of The National Advisory Cancer Council. 300 pages, Illustrated. The Year Book Publishers, Inc., Chicago, Ill., publishers, 1950. Price \$6.

**LIPPINCOTT'S QUICK REFERENCE BOOK FOR NURSES**, by Helen Young, B. N., Director of Nursing, Finsenitus, Columbia-Presbyterian Medical Center, Editorial Board, Department of Nursing, Faculty of Medicine, Columbia University, Presbyterian Hospital School of Nursing, New York; Mary Elizabeth Altmann, A. M., B. N., Assistant Professor of Nursing, Elisabeth S. Gol, R. S., B. N., Instructor in Nursing; Eleanor Lee, A. H., B. N., Assistant Professor of Nursing; G. Harriet Mantel, A. M., B. N., Instructor in Nursing, Helen E. Pettit, B. S., B. N., Assistant Professor of Nursing. 6th edition. 626 pages. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1950. Price \$3.

**WORLD SURGERY, 1950**, by Stephen A. Zelenin, M. A., M. D., F. A. C. S., F. I. C. S., Abstract and News Editor, *Journal of the International College of Surgeons*; Instructor for International Abstracts of Surgery and Surgery, Gynecology and Obstetrics, formerly Assistant Chief, Division of Publications, Bureau of Medicine and Surgery, U. S. Navy, and Assistant Editor, *J. B. Lippincott Medical Bulletin*. 177 pages; 57 illustrations. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1950. Price \$6.

## BOOK REVIEWS

**SIMMONDS' DISEASE Extreme Insufficiency of the Adrenocortopexis** by R. F. Farquharson  
M. B. F. R. C. P. (C) Professor of Medicine and Head of the Department, University of Toronto, Physician in Chief, Toronto General Hospital, Toronto, Canada  
Publication Number 34 American Lecture Series, 91 pages, Illustrated, Charles C Thomas, Publisher, Springfield, Ill., 1950 Price \$2

The book is one of the American Lecture Series and is an excellent presentation of the pathology, pathogenesis, clinical picture, and diagnosis of Simmonds' disease. The presence of the syndrome is discussed as occurring only when there is destruction of the pituitary gland. The destructive lesion is caused by one of the following conditions—Ischemic necrosis, fibrosis, tumor, or granuloma. Each of these is well described. The lack of mention of ACTH, one of the recent greatest medical discoveries, as applied to the treatment and physiology of the pituitary gland, is a serious omission. Although the relation of the pituitary gland to the other endocrine glands is discussed, the more recent physiologic knowledge of this relationship is omitted. There are many references throughout the text and an excellent bibliography at the end. The book would be read with profit by the general medical man, the obstetrician, and with interest by the endocrinologist. It is a comprehensive study of the syndrome—  
*Commander H. J. Ignat (MC) U. S. N.*

**Textbook of Bacteriology** by Joseph M. Dougherty, A. B., M. A., Ph. D., Dean of the School of Science and Professor of Bacteriology, Villanova College, Fellow of the American Association for the Advancement of Science, and Anthony J. Lamberti, B. S., M. S., Instructor in Bacteriology and Parasitology, Temple University School of Medicine, formerly Instructor in Bacteriology, Villanova College. Member of the American Public Health Association. 2d edition, 491 pages, Illustrated, C. V. Mosby Co., St. Louis Mo., publisher, 1950 Price \$3.75

The authors believe that many of the available textbooks of bacteriology are too extensive for undergraduates. Although the need for less comprehensive coverage is admitted, a brief account, if it is to be adequate, requires wisdom and mastery in selection and presentation, perhaps to a greater degree than is necessary for more complete texts. This book contains an abbreviated survey of all aspects of medical microbiology, but these are too superficially treated, and some sections are antiquated. Examples are found in the discussion of the relation of "precipitins" to "agglutinins," and of the value of serum therapy in meningococcal infections. An excellent opportunity to demonstrate the principles and use of antigenic analysis is neglected in the section on *Salmonella*. Reference to antigenic differences in the *Shigella* group is omitted entirely. For the purpose intended, the reviewer believes that thorough study of illustrative parts of a good textbook, under able direction, would supply a sturdier foundation than the use of an almost equally expensive but superficial survey, such as the text under consideration—*Lt Col L. R. Kahn, MSC, U. S. A.*

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mann, Cyrus C. Sturgis, Robert H. Williams. 736 pages. W. B. Saunders Co., Philadelphia, Pa., publishers, 1950. Price \$10.

This book is an excellent treatise on modern current therapy from the point of view of practicing physicians who tell in a clear, concise manner the procedures they recommend for the treatment of various diseases which are based on the tests obtained from their own private practice. The obsolete methods contained in the 1949 volume have been deleted; valuable information in the 1949 edition has been repeated, and all the new and practical treatments have been added. The contents of the book have been divided into 13 sections which cover the diseases in the following categories: (a) infections, (b) respiratory system, (c) cardiovascular system; (d) blood and spleen; (e) digestive system, (f) metabolism and nutrition; (g) endocrine system; (h) urogenital tract; (i) venereal diseases; (j) skin; (k) allergy; (l) nervous system; (m) locomotion; (n) obstetric and gynecologic conditions; and (o) physical and chemical agents.

The changes in the treatment of the various diseases by chemotherapeutic advances may be illustrated by referring to the chapter on the modern prevention and treatment of malaria where new drugs have almost entirely replaced the old standby, quinine. To those who wish to criticize or take issue with certain recommendations made by the authors as to the best therapy available for the treatment of certain diseases there is room for argument; for example, the use of electro-shock therapy in manic depression and schizophrenia. The book is well written, well bound, and printed in an easy-to-read bold type on paper of excellent quality. The index is complete—which often saves valuable time when quick reference is necessary. It is highly recommended to the student and practicing physician, both of whom are interested in keeping current with the best in practical therapy—*Capt. C. R. Ball (MC) U. S. N.*

*Office Orthopedics*, by Lewis Caren, M. D. F. A. C. S. Attending Orthopedic Staff, The Orthopedic Hospital, Veterans' Hospital, Los Angeles County Hospital, Cedars of Lebanon Hospital, Los Angeles, and Los Angeles Tuberculosis Sanitarium, Monrovia, Calif.; Assistant Professor of Orthopedic Surgery, College of Medical Evangelists, Los Angeles. 232 pages, 156 illustrations. Lea & Febiger, Philadelphia, Pa., publishers, 1950. Price \$5.

This little book fills a gap which exists in the orthopedic information available to the student and general practitioner. It furnishes practical information on orthopedic subjects that will come as an invaluable aid to those who are called on to treat minor orthopedic conditions and to recognize major orthopedic lesions in general practice, especially in outlying communities. Many of these minor conditions are all too briefly dismissed in standard orthopedic texts.

The outstanding quality of the book is the detail given to the procedures that can easily be carried out in the office, such as the treatment of minor fractures and foot complaints. Materials, specifications for simple apparatus, and directions for their use are carefully described. The section dealing with symptom diagnosis is especially useful. The author is careful to state in his preface that "at least one complete standard work on orthopedic surgery should be available to the physician who uses this volume." When discussing the types of lesion that are suitable for treatment in office practice he usually states specific limitations and the reader is warned, at least by inference, of those which are not. The impression is also given, fortunately, that many of the conditions are beyond the scope of the general practitioner.

The work covers briefly, and often by mere mention, so many diverse orthopedic and related conditions that it suffers from oversimplification. It is also questionable whether the treatment (not the recognition) of clubfoot should come in the realm of the general practitioner. Certainly the technique of

cervical and lumbar sympathetic block should not be encouraged as office practice for the uninitiated. In spite of the fact that the author has felt compelled to run the gamut of orthopedic diagnoses from arthrolysis to Waddell's disease, the material is well presented and the precautions clearly stated. The book is recommended as a useful reference for the general practitioner who must carry out some orthopedic office procedures.—Col. F. A. Brat, MC U. S. 1

**THE PATHOLOGY OF ARTICULAR AND SPINAL DISEASES** by Douglas H. Collins O. B. E. M. D. (Liverpool). Reader in Clinical Pathology in the University of Leeds; formerly Rheumatism Research Fellow in the University of Leeds. E. M. A. Pathologist and Medical Superintendent, Barncliffe Hospital, Sheffield; Junior Lecturer and Hull Fellow in Pathology in the University of Liverpool. 331 pages. Illustrated. The Williams & Wilkins Co., Baltimore, Md. publisher 1958. Price \$7.

This textbook provides an up-to-date and well-illustrated account of the morbid anatomy of the joints and spine. The introductory chapters deal primarily with the anatomy and physiology of the joint tissues and bone. The following 15 chapters discuss the diseases of joints and the spine in a conventional pathologic sequence. An attempt is made to relate and compare the various diseases and orient them within the framework of general pathology. The illustrations, which are all original, are exceptionally good. They have been prepared from post-mortem material with only an occasional radiograph to demonstrate certain unusual features. To quote the author: "Few pathologists have had the opportunity of studying these diseases in the post-mortem room or in the histological laboratory and much of their knowledge of the pathophysiological processes involved is founded on pathology which is only the shadow without the substance of morbid anatomy."

Tumors of bone receive only brief mention—which seems regrettable in a text of this nature. Disorders of bone other than those directly affecting joints are reviewed in chapter 3 in summary form. The book should appeal not only to the pathologists but to orthopedists and radiologists as well—Commander K. P. Knudson (MC) U. S. N.

**COMMUNICABLE DISEASES**, edited by Robert L. Pollen, A. B. M. D. F. A. C. P. Professor of Graduate Medicine, Director of the Division of Graduate Medicine, and Vice Dean of the School of Medicine, Tulane University of Louisiana; Senior Consulting Physician, Charity Hospital of Louisiana at New Orleans; Consultant in Medicine, U. S. Army Administration Hospital, New Orleans; Lt. Consultant to the Surgeon General, Department of the Army, Washington, D. C. 1173 pages. Illustrated. Lea & Febiger, Philadelphia, Pa. publisher 1958. Price \$20.

This new book is a compilation of articles written by 53 contributors most of whom are or have been associated with Charity Hospital of Louisiana at New Orleans. As such it reflects largely the experience and practice in communicable disease management at that institution. Although of value as a textbook, this work was produced chiefly to aid the clinician in recognizing and managing communicable illnesses, particularly in the earliest stages. For this reason the arrangement of contents is unconventional in that the communicable diseases are grouped according to predominant manifestations. Although subject to pedagogic criticism, this manner of organization increases the value of the book as a clinical reference. This quality is further enhanced by the inclusion of numerous tables pertaining to diagnostic criteria and treatment which may be easily and rapidly consulted by the busy clinician. On the other hand, each topic is presented in traditional textbook form for ease in reading. The illustrations are adequate and the reproductions are excellent. In general the subjects are well covered and include references to some of the most recent literature. Some exceptions are remarkable, however. For instance, the roles of DDT, benzyl

benzoate, and undecylenic acid in treating pediculosis, scabies, and dermatophytosis, respectively, are de-emphasized in favor of the older types of treatment. This seems unjustifiable in view of the military medical experience with these compounds. Similarly the article on rheumatic fever fails to mention the use of penicillin as a prophylactic by persons who have had the disease. Under epidemic diarrhea of the newborn the replacement of fluids and electrolytes is not sufficiently stressed or described in adequate detail. Aside from these deficiencies, the text is reasonably up to date, particularly with regard to the field of antibiotic therapy. The book is recommended for reference use in all military hospitals and large dispensaries—*Maj C. M. Therhart, MC, U. S. A.*

**ADVANCES IN INTERNAL MEDICINE, Volume 3.** Edited by William Dock, M. D., *Long Island College of Medicine, Brooklyn, N. Y.*, and I. Snapper, M. D., *The Mount Sinai Hospital, New York, N. Y.*. 478 pages, Illustrated. Interscience Publishers, Inc., New York, N. Y., publishers, 1949. Price \$8.50

This third volume in a series devoted to advances in internal medicine is intended to present current information and concepts of importance within that field. Such a book, as the editors were well aware, becomes dated almost as soon as it is off the press. However, such an objection is ameliorated by the quality of the presentation. It will undoubtedly remain an informative volume until the next edition is ready for release. The presentation is not as an abstract or digest of current literature, but rather a series of articles on subjects of current interest. There is no attempt at continuity of subject presentation. This volume reviews the use of British anti-leishman, the hemolytic anemias, factors modifying the therapeutic activity of penicillin, streptomycin, histoplasmosis, anilthyroid compounds, diagnosis by enzymic methods, plasma fractionation, heat acclimatization, and new therapeutic agents in neurologic conditions.

The list of contributors is impressive; their contributions equally so. The subjects are covered concisely and completely. There is no "rehash" of old or readily available material. Complete bibliographies are appended. An objection might be made to the lack of organization in regard to subject presentation, but this is a minor consideration. The book is cloth bound, the printing and illustrations are of good quality. This volume is most highly recommended, especially for the physician too busy or too far separated from medical library facilities to avail himself of current medical literature.—*Lieutenant Commander J. R. Larson, MC, U. S. N.*

**QUINIDINE IN DISORDERS OF THE HEART.** by Harry Gold, M. D., Professor of Clinical Pharmacology at Cornell University Medical College; Attending-in-Charge of the Cardiovascular Research Unit at the Beth Israel Hospital; Attending Cardiologist at the Hospital for Joint Diseases; Managing Editor of the Cornell Conference on Therapy. 115 pages. Paul B. Hoeber, Inc., New York, N. Y., publisher, 1950. Price \$2.

This small monograph provides the clinician with practically all he needs to know concerning the use of quinidine in the treatment and prevention of disorders of the heart beat. Dr. Gold has drawn on his wide clinical and experimental knowledge to write a practical manual that will prove invaluable in the internist and the general practitioner alike. The indications, therapeutic actions, toxic actions, absorption, and elimination of quinidine are adequately described. There is a detailed plan for an effective yet safe dosage schedule. A regimen for intravenous administration, particularly in the control of ventricular tachycardia, is presented at great length. The use of quinidine in each of the ectopic rhythms is described. Whether the author believes that digitalis is the drug of choice in treating an arrhythmia, he so states. In an excellent chapter on the combined use of quinidine and digitalis he discusses this controversial subject.

general principles of dietotherapy. The importance of nutrition in preventive medicine is brought out in chapters on nutrition in public health practice and in industrial medicine. Under this latter heading the authors discuss the nutrient requirements in relation to physical efficiency under various forms of stress.

The appendix contains tables useful for formulating therapeutic diets and in making nutritional evaluations of diets. This book is of great interest not only to clinicians but to workers in the field of nutrition and public health.—*Maj C. J. Koch, MSC, U. S. A.*

*NUTRITION AND DIET THERAPY*, by Fairfax T. Proudfit, formerly Instructor in Nutrition and Diet Therapy, University of Tennessee College of Medicine and Tennessee School of Nursing; Director of Dietary Department, John Gaston Hospital, Memphis, Tennessee; and Corinne Bogert Robinson, Lecturer in Nutrition and Dietetics, Temple University School of Medicine, Philadelphia; formerly Instructor in Nutrition and Diet Therapy, Columbia University School of Nursing. 10th edition. 976 pages. Illustrated. The Macmillan Co., New York, N. Y., publishers, 1950. Price \$4.

This text, basically for the teaching of student nurses, is also a valuable reference book for anyone interested in diet in health and disease. Separate sections cover normal nutrition; nutrition in such conditions as pregnancy, lactation, and childhood; diet in disease; and elementary cookery. Of special value to those working with diets are the complete tables of food values that are found in the appendix. Summary tables of all food elements as well as of digestive processes are included in the text. A separate chapter on diagnostic tests involving diets is a welcome addition not found in most texts of this type. The chapters on diet therapy include the physiologic or pathologic factors underlying the type of diet used. Foods are classified as those to be used and those to be avoided, also in handy tabular form. A basic diet and sample menu is provided for each special diet. The section on fundamental cookery should be extremely useful for those preparing special diets in the home.—*Lt. H. M. E. Lisenbruegger, MC, U. S. N.*



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the following publications:

*Current List of Medical Literature*

(Army Medical Library) Weekly listings of  
journal contents by author, subject index  
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*Quarterly Cumulative Index Medicus*

(American Medical Association) Author and  
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*Index-Catalogue of the Library of the Surgeon  
General's Office, U. S. Army*

(Army Medical Library) Now in Fourth Series,  
Vol. X, Letter M (first half). Author and  
subject.

## COVER PHOTOGRAPH

Hospital Corpsman signals a helicopter  
to pick up a wounded man for evacuation  
to a hospital.

## Foreword

The UNITED STATES ARMED FORCES MEDICAL JOURNAL represents the unification of the BULLETIN OF THE UNITED STATES ARMY MEDICAL DEPARTMENT, published since 1922, and the UNITED STATES NAVAL MEDICAL BULLETIN, published since 1907. This joint periodical is the medium for disseminating information of administrative and professional interest to all medical personnel of the Department of Defense.

It is the aim to include in each issue administrative directives, original scientific and professional articles, editorial comments on current professional literature of special interest, clinical notes, descriptions of new devices and instruments, abstracts of articles from various medical periodicals, and notices and reviews of newly published professional books of interest to all commissioned medical personnel of the Department of Defense.

The Director, Medical Services, and the Surgeons General of the several services extend an invitation to all medical officers, dental officers, Medical Service Corps officers, Nurse Corps officers, officers of the Veterinary Corps, all officers of the ancillary services of the medical services of the Armed Forces, and to the medical consultants of the Army, Navy, and Air Force to submit manuscripts for publication in this JOURNAL.

RICHARD L. MEILING, M. D.,  
*Director, Medical Services,  
Department of Defense.*

RAYMOND W. BLISS,  
*Major General, U. S. A.,  
Surgeon General, U. S. Army.*

CLIFFORD A. SWANSON,  
*Rear Admiral (MC) U. S. N.,  
Surgeon General, U. S. Navy.*

HARRY G. ARMSTRONG,  
*Major General, U. S. A. F.,  
Surgeon General, U. S. Air Force.*

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*Captain, Medical Service Corps,*  
*United States Air Force.*

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OFFICE OF THE SECRETARY OF DEFENSE  
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MEMO: Personnel of the Medical Services, The United States Armed Forces.

From the time the Office of Medical Services was established a year and a half ago, continual stress has been placed on the mission of the military medical services in support of the combatant arms. A year ago this month, the Secretary of Defense issued a directive to the Secretaries of the Army, Navy, and Air Force calling their attention to this mission and to the urgent need for scaling the organization to this end.

In June 1950 the full meaning of this mission became suddenly quite clear when United States forces were committed in support of the United Nations' decision to undertake armed police action in Korea. The request of the Far Eastern commander for additional forces entailed the prompt assignment of several hundred medical officers at various points in support of the new operations. These medical officers were available when needed.

This orientation of the military medical services to meet their primary mission which is in support of the combatant arms will prepare us for any development which the Armed Forces and the nation may encounter.

*Richard L. Meiling*

Richard L. Meiling, M.D. *(Signature)*  
Director of Medical Services



# UNITED STATES ARMED FORCES MEDICAL JOURNAL

*Published monthly by the Department of Defense*

T. W. FARRAR, Captain (MC) U.S.N., Editor in Chief

WAYNE G. BRANDSTADT, Colonel, MC, U.S.A., Associate Editor

ALFRED A. GENTILCORE, Captain, U.S.A.F. (MSC), Associate Editor



THE PRINTING OF THIS PUBLICATION HAS BEEN APPROVED BY THE DIRECTOR OF THE BUREAU OF THE BUDGET, OCTOBER 19, 1949

## Detection of Early Carcinoma of the Uterus

SARKIS S. SARKISIAN, Lieutenant (MC) U.S.N.<sup>1</sup>

PAPANICOLAOU and Trant (1), Meigs et al. (2), Ayer (3), Graham and Moigs (4), Gates and Warren (5) and others have already indicated the value of the smear examination for malignant cells. At the U. S. Naval Hospital, San Diego, Calif., the technique for mass evaluation of exfoliative cytology as compared with biopsy in early carcinoma of the cervix was undertaken in June 1948 by the Department of Pathology in cooperation with the Department of Obstetrics and Gynecology.

This is a report of 3,420 cases examined from October 1948 through December 1949; included are 1,500 cases (examined during the period October 1948 through June 1949) previously reported (6).

### METHODS

When the appearance of a smear is suggestive of cancer, a specimen of tissue from the cervix at four opposed points is obtained for biopsy. If the biopsy is negative or if it reveals carcinoma, a 360° cone is obtained by sharp dissection; cautery is not used in order to procure a satisfactory histologic preparation. The tissue is then subjected to complete serial sectioning and microscopic examination. Thus an accurate representation of the actual pathologic changes is

<sup>1</sup>U.S. Naval Hospital, San Diego, Calif.

obtained and we are then in a position to state with a fair degree of accuracy whether the cancer is preinvasive or invasive. In the invasive carcinomas a smear is examined each week for the first month during and after irradiation; after that a smear is examined each month. If malignant cells continue to desquamate 6 months post-therapeutically, a specimen for biopsy is obtained which, if possible, is a 360° cone of the cervix. This method of follow-up of cervical carcinomas will detect radio-resistant cancer requiring surgical intervention—a modified Wertheim procedure.

#### FINDINGS AND RESULTS

In the 3,420 patients examined, 42 (1.23 percent) cancers were confirmed by biopsy. Forty-one (1.19 percent) were squamous cell carcinoma of the cervix uteri—30 (0.87 percent) were preinvasive carcinomas of the cervix, and 11 (0.33 percent) were invasive carcinomas. There was 1 (0.03 percent) adenocarcinoma of the endometrium. In an additional 40 patients biopsy has not been completed. The statistics will be revised as information is gathered concerning these cases. Of the 3,420 cases, 17 (0.50 percent) were reported as suspicious of cancer on cervical smear but subsequent biopsy proved that the lesion was benign.

Thus far, of the 22 uteri removed incident to treatment for preinvasive squamous cell carcinoma of the cervix, 15 (68.2 percent) show no histologically demonstrable carcinoma after serial section of the distal 2.5 cm. of the cervix uteri; in 7 (31.8 percent) uteri preinvasive squamous cell carcinoma was noted.

Table 1 lists 42 cases of cancer. In some cases photomicrographs of histologic sections that are representative of the group as a whole are shown to depict the cytologic and histologic criteria on which a diagnosis of cancer is based.

Figure 1 depicts the incidence of carcinoma of the cervix uteri in

TABLE 1

Case number	Smear number	Age (years)	Diagnosis as confirmed by biopsy
1	P15-48	27	Preinvasive carcinoma
2	P129-48	30	No
3	P174-48	35	No
4	P196-49	40	Invasive carcinoma
5	P38-49	44	No
6	P479-49	25	Preinvasive carcinoma
7	P494-49	30	No
8	P524-49	30	No
9	P579-49	21	Invasive carcinoma
10	P611-49	44	No
11	P644-49	29	Preinvasive carcinoma
12	P654-49	23	No
13	P671-49	24	No
14	P146-49	26	No
15	P828-49	30	No
16	P188-49	39	Invasive carcinoma
17	P940-49	40	Preinvasive carcinoma
18	P599-49	23	No
19	P1006-49	69	Invasive carcinoma

TABLE I—Continued

Case number	Smear number	Age (years)	Diagnosis as confirmed by biopsy
20	P1114-49	29	Preinvasive carcinoma.
21	P1183-49	34	Invasive carcinoma.
22	P1175-49	27	Preinvasive carcinoma.
23	P1222-49	38	Invasive carcinoma.
24	P1211-49	26	Preinvasive carcinoma.
25	P1260-49	22	Do
26	P1305-49	47	Do
27	P1350-49	34	Do
28	P1353-49	25	Do
29	P1447-49	22	Do
30	P1501-49	30	Do
31	P1530-49	32	Invasive carcinoma.
32	P1544-49	35	Preinvasive carcinoma
33	P1715-49	32	Do
34	P1827-49	56	Invasive carcinoma.
35	P1849-49	29	Preinvasive carcinoma
36	P1933-49	22	Do
37	P2153-49	71	Invasive endometrial carcinoma.
38	P2215-49	41	Preinvasive carcinoma.
39	P2226-49	36	Do
40	P2441-49	34	Do
41	P2494-49	41	Do
42	P2535-49	36	Do

<sup>1</sup> Denotes cases with photomicrographs appended.

the various age groups represented. The age group of patients seen at this hospital lies in the 21- to 30-year bracket; approximately 30 percent of the women are in the menopausal age group. Therefore, there is an overemphasis of values in the younger age group in this study.

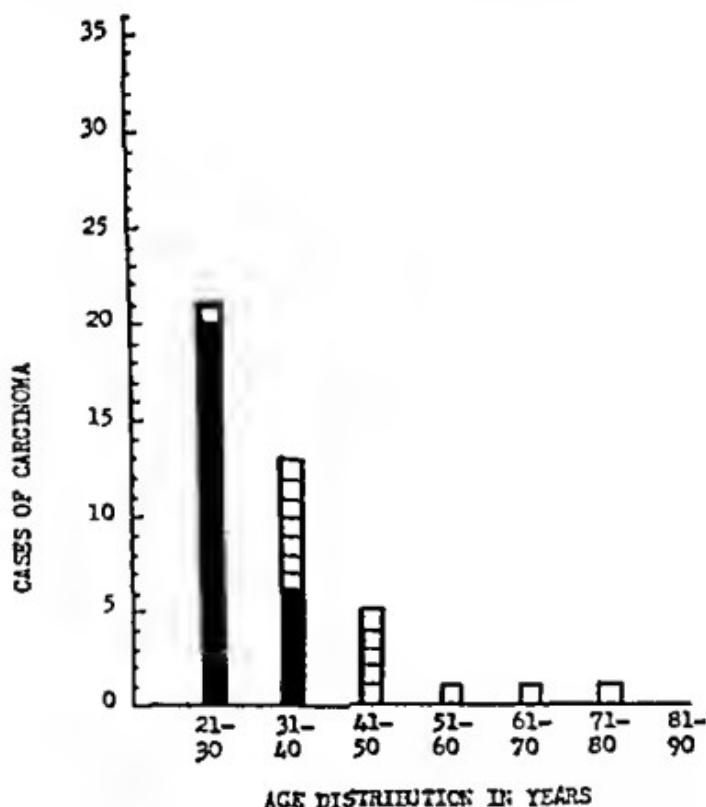


Figure 1.—White area represents the number of cases of invasive carcinoma; the black area represents preinvasive carcinoma.



A



B



Figure 2.—Case 8, listed in table I. (A) Papanicolaou smear. (B) Tissue biopsy. (C) Tissue biopsy.

#### DISCUSSION

The cytologic method for diagnosis of carcinoma is not new. The pathologist has been making a diagnosis of cancer on cell block preparations of fluids from the abdomen, chest, and urinary tract for years; however, he looked for islands or groups of cells in making a diagnosis of carcinoma. Papanicolaou spearheaded the objective of examining the individual cell for diagnostic features of malignancy.



A



B



C

Figure 3.—Case 18, listed in table 1.  
(A) Papanicolaou smear. (B) Tissue  
biopsy. (C) Tissue biopsy.

In 1929, MacCarty (7), and later Guttman and Halpern (8), called attention to the changes in the nucleolus of the cell as an aid in the diagnosis of malignancy; however, the latter pointed out the inaccuracy of depending on this change alone. Hauptmann (9) has described the cytologic features of malignant cells and classified them into five basic types. Peters (10), Fremont-Smith et al. (11), Wiles and Hellwig (12), Schesley et al. (13), Lombard et al. (14), and others have pointed out the value of the cytologic smear examina-



A



B

Figure 4—Case 3, listed in table 1. (A) Papainicolaou smear. (B) Tissue biopsy. (C) Tissue biopsy.



C

tion for the detection of cancer. The salient features of a malignant cell are based upon a comparison of the cell with a normal-type cell of the tissues de-quamatting these cells. There are certain basic features present—these are demonstrated by the photomicrographs of malignant cells shown in figures 2.1, 3.1, 4.1, 5.1, 6.1, and 7.1. In the malignant cell there are hyperchromatic nuclei with coarse chromatin clumps and irregular nuclear borders; the nuclear-cytoplasmic ratio is generally greatly decreased, i. e., the larger the nucleus, the greater is the likelihood of malignancy. Occasionally, multinucleated cells are seen (figures 4.1, 5.1, 6.1, and 7.1). Thus, the morphology of the

Figure 5.—Case 28, listed in table 1.  
(A) Papanicolaou smear. (B) Tissue biopsy. (C) Tissue biopsy.



A



B



C

individual cell is as important in determining the presence of cancer as is the architectural pattern of a tissue, and it is almost as reliable. Figure 2B demonstrates the architectural pattern of preinvasive carcinoma in immediate proximity to benign squamous epithelium. Figure 5B is a totally bizarre architectural pattern of invasive carcinoma.

By examining the photomicrographs of the Papanicolaon smear and comparing the malignant cells with the respective tissue biopsy, one can identify the source of the cells. The source of the malignant cells in the smear can be observed in figures 6A, 6B, 7A, and 7B. Once



A



B

Figure 6—Case 14, listed in table I. (A) Papamicoelaou smear. (B) Tissue biopsy.

the pathologist is acquainted with the cytologic variations of the normal desquamated cell, the presence of malignant changes can readily be detected.

In the examination of 22 uteri which were surgically removed incident to treatment for preinvasive squamous cell carcinoma of the cervix, 68.2 percent revealed no cancer. Does this mean that carci-



A



B

Figure 1—Case 6, listed in table I. (A) Papamicoelaou smear. (B) Tissue biopsy.

noma of this type can be removed by a 360° conization of the cervix? It would appear, in the light of our present knowledge, that this does not constitute adequate treatment of carcinoma *in situ*.

Younge et al. (15) states: "If the carcinoma *in situ* involves only the surface epithelium and does not involve the cervical glands, thorough destruction of the surface lesion by cauterization or complete excision by sharp conization will apparently cure 85 percent of such cases." This is a very brave stand; but, until more is known about this disease, hysterectomy is the treatment of choice regardless of the age of the patient.

The foregoing indicates the highly specialized and controversial field we are dealing with and by virtue of this, it is believed that the cytologic smear methods for diagnosis of malignancy should be left to the highly trained pathologists in well-equipped laboratories where proper evaluation can be made. Jeopardy to the patient or embarrassment to the physician can then be obviated. Novak (16) states " \* \* \* the chief workshop for this purpose should for the present be well-organized and well-equipped clinics."

#### SUMMARY

Of 3,420 patients screened cytologically 42 or 1.23 percent showed cancer. In 17 (0.50 percent) a false positive was reported. Of 22 uteri examined after surgical removal incident to treatment for pre-invasive squamous cell carcinoma, 15 (68.2 percent) showed no histologic evidence of cancer.

A diagnosis of preinvasive squamous cell carcinoma of the cervix should not be made until a 360° cone of the cervix is subjected to serial examination.

The Papanicolaou-Traut stain of a cervical smear is of definite value in the detection of early carcinoma of the uterine cervix.

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# Treatment of Tinea Capitis With Local Medication

WILLIAM C. MARSH, Commander (MC) U. S. N.<sup>1</sup>

TREATMENT of ringworm of the scalp (especially when it is caused by *Microsporum audouini*) has always been a problem to physicians treating dependents in out-patient clinics. It was thought for many years that roentgen epilation was necessary for cure. Even when technicians adequately trained in the Kienböck-Adamson technique of roentgen epilation were available, the pediatric or dermatologic follow-up care was not always available. The transient status of patients added to the difficulties. In recent years the work of Schwartz et al. (1), MacKee et al. (2), and Scully et al. (3) in local therapy has given hope that this condition may be treated with local medication on a true out-patient basis.

Thirty-two patients (22 boys and 10 girls) with *M. audouini* infections were treated between December 1948 and August 1949. Of these, 31 were treated with a preparation containing 25 percent zinc undecylenate, 2 percent undecylenic acid, and 5 percent salicylanilide in a carbowax base. Of the 32 patients, 20 had previously received local therapy including 10 percent copper undecylenate ointment; sopronol liquid and ointment; tincture of iodine; 10 percent ammoniated mercury ointment; and 5 percent salicylamlid ointment. None of these medications had been effective although some had been used as long as 3 months.

*Age incidence.*—Fourteen were between 2 and 6 years of age; 15 between 7 and 9 years of age; and 3 from 10 to 11 years of age.

*Epidemiology.*—Twelve patients had siblings who also had ringworm of the scalp.

*Cultural studies.*—All patients were first examined in the clinic with the use of a filtered ultraviolet light. Fluorescent hairs were removed with a fine forceps, coated with eosin in collodion, and planted on Sabouraud's medium. *M. audouini* was obtained in 31 cases and *M. lanosum* in 1 case.

<sup>1</sup>U. S. Naval Hospital, National Naval Medical Center, Bethesda, Md.

*Inflammatory response.*—Using the criteria determined by Scully et al. (3), each patient was graded 1-plus to 4-pluses. The criteria for grading were used either at the start of treatment or during the course of treatment. Six patients showed a 1-plus reaction; five patients a 2-plus reaction; five patients a 3-plus reaction; and four patients a 4-plus reaction or typical kerion formation (a boggy mass, with deep-seated suppuration and multiple draining sinuses).

In the severe inflammatory cases, alopecia developed, which was feared to be permanent at the time. However, a check of three of the four severe kerion reactions with alopecia revealed that all have had complete regrowth of hair. The fourth case was not observed.

#### TREATMENT

Instructions given to the parents on the initial visit to the clinic are of prime importance. The infected areas are pointed out to the parents, and in some cases outlined with gentian violet, parents were given the following instructions: (a) Shave all infected areas, including at least 1 inch of surrounding normal hair. If three or more areas larger than 25-cent pieces were noted, the entire scalp was shaved. (An occasional exception to this rule was allowed in girls.) (b) The applicator was to be made by placing three or four layers of soft cloth over the round head of an old-fashioned type wooden clothespin and securing the cloth with a rubber band. (c) All infected areas were to be rubbed with the ointment 10 minutes, by the clock, twice a day.

The patients were examined under the filtered ultraviolet light at weekly intervals. Manual epilation was not practiced unless all the infected hairs could be removed (if less than 10 fluorescent hairs were present).

A favorable sign is the occurrence of an inflammatory reaction after the institution of treatment. Applications of the ointment were continued unless severe kerion developed; then hot compresses of magnesium sulfate were applied to control the infection. Other factors which indicate a favorable outcome are loosening of the hair and rapid loss of the fluorescent property of the hair (which changes from the original green to a gray color under the ultraviolet light).

Criteria of cure in our series was the absence of any fluorescent hairs for at least 2 months after cessation of treatment and a negative culture on Sabouraud's medium after negative examination under the ultraviolet light 1 month previously.

The results of treatment of *M. audouini* infections in the series are outlined in table 1.

TABLE 1.—Results

Weeks of treatment	Number of cases cured	Percent of total	Weeks of treatment	Number of cases cured	Percent of total
6.....	1	3 2	15 to 17.....	2	6 5
7.....	1	3 2	18 to 20.....	1	3 2
8 to 11.....	15	49 4	Total.....	31	100 0
12 to 14.....	11	35 5			

Scully et al. (3) suggested that, with careful clinical care and follow-up and with the cooperation of parents, most cases of tinea capitis due to *M. audouini* could be cured by local medication. It is believed that the excellent results in this series were due to the medication used and the excellent cooperation of the parents. Over 90 percent of the patients were discharged from treatment as cured in 4 months or less. This period of time compares more than favorably with that required by roentgen epilation and follow-up care.

It is our opinion at this time that the military service could easily adopt this routine for out-patient care of tinea capitis. Furthermore, local medication should be used for a minimum of 3 months before roentgen opilation is considered.

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# The Clinical Use of Antibiotics

## III. Treatment of Dental Infections<sup>1</sup>

PERRIN H. LONG, Colonel, MC, A. U. S.<sup>2</sup>

THE advent of the sulfonamides and of the antibiotics has placed powerful therapeutic tools in the hands of the dental officer and has revolutionized the treatment of dental infections. The dental officer should keep abreast of the latest advances in the field of the anti-infective agents, and especially in that of the antibiotics, because, at present, there are few indications for the primary use of the sulfonamides in dental infections. An understanding of proper dosage schedules and the clinical pharmacology and toxicology of the antibiotics is necessary if maximal benefits are to be reaped from the use of these agents in the prevention or treatment of dental infections.

### *Actinomycosis*

Because actinomycosis may arise in or about the structures of the jaw, the dental officer must always be on the lookout for it in patients in whom there is a delay in the resolution of, or a recurrence of, an inflammatory process, especially if the infection is accompanied by multiple draining sinuses. The treatment of actinomycosis of the jaw represents an instance which requires the cooperative efforts of the dental and medical officers. A combination of a preparation of penicillin G with sulfadiazine should be used in treating this disease.

### *Alveolar Postoperative Infection*

Alveolar postoperative infection in general is caused by a mixture of micro-organisms such as alpha hemolytic streptococci, staphylococci, *Borrelia vincentii*, and *Fusiformis dentium*. It occurs most frequently after extraction of third molars in the mandible. A preparation of penicillin G, especially an ointment of penicillin in an anhydrous, nonhydroscopic base, is recommended. Rarely more than two or three treatments at 24- or 48-hour intervals are needed to bring

<sup>1</sup>The third of four articles on this subject. Parts I and II appeared in the August and September issues of this JOURNAL.

<sup>2</sup>Department of Preventive Medicine, Johns Hopkins University School of Medicine, Baltimore, Md.

about the desired effect. If the indications are that an extraction will be difficult, it is a good plan to administer, as a prophylactic measure, 300,000 units of procaine penicillin G in oil with 2-percent aluminum monostearate added, about 4 to 6 hours before the operative procedure.

#### *Cellulitis*

Dental infection is a common source for the development of extensive and rapid cellulitis of the floor of the mouth. Such a cellulitis represents a problem that frequently requires the combined attention of both the dental and medical officer. It requires prompt and intensive treatment if serious consequences are to be avoided. For instructions, see Streptococcal Infections.\*

#### *Cheilosis*

Angular cheilosis, especially if associated with lesions of the tongue, may be an early manifestation of riboflavin deficiency. The angular lesions may become secondarily infected with hemolytic streptococci or staphylococci. Give adequate doses of riboflavin provided in a good B-complex multivitamin preparation. If the infection is mild, nothing need be done except to observe the rules of cleanliness. If severe, the administration of two doses of 300,000 units of procaine penicillin G in oil with 2-percent aluminum monostearate added, at intervals of 72 hours, will, as a rule, control the infection.

#### *Gangrenous Stomatitis*

This disease occurs in debilitated persons. Infection does not play a primary role but may be an important secondary factor. The bacteria involved are the normal inhabitants of the mouth. In treating patients with this disease use those measures that will normally control the cause of the debilitation. Initially, crystalline penicillin G is given intramuscularly in doses of 25,000 units every 3 hours. Aureomycin, given as recommended for moderately ill patients, may be used.

#### *Herpetic Stomatitis*

Herpetic stomatitis is caused by the virus of herpes simplex and may occur as an isolated instance or may be epidemic. It is frequently misdiagnosed because the white, glistening vesicular caps are mistaken for flakes of exudate. Aureomycin should be tried as recommended for moderately ill patients. The auxiliary therapy is that of acute tonsilitis or pharyngitis. The soreness of the throat is generally out of proportion to the visible lesions.

\* Part II of this series p. 1001; I. S. Armed Forces Medical Journal Sept. 1950, and Part IV (to be published next month).

### *Maxillary Sinus Infection*

If the dental officer has the misfortune to fracture the floor of the maxillary sinus during the extraction of an upper molar, he should promptly seek the advice of a competent otolaryngologist regarding specific treatment.

### *Oral Moniliasis*

This disease is not known to respond to sulfonamides or antibiotics.

### *Osteomyelitis*

Osteomyelitis of the mandible often follows a compound fracture of the jaw or the extraction of lower molar teeth when there has been much destruction of alveolar bone. When the infection is sharply localized, a typical "dry socket" is produced. If, however, the infection spreads to the inferior dental vessels, an extensive osteomyelitis may result. The bacterial flora in osteomyelitis of the mandible is generally mixed.

*Treatment.*—Either penicillin G or aureomycin may be used. If crystalline penicillin G is employed, the dose should be 25,000 units administered intramuscularly every 3 hours until the infection is controlled. The penicillin preparation of choice for most instances in which this drug is indicated is procaine penicillin G (300,000 units) with 100,000 units of crystalline penicillin G added. It should be given in watery suspension intramuscularly every 8 to 12 hours. As a third choice among the penicillins, 300,000 to 600,000 units of procaine penicillin G in vegetable oil with 2-percent aluminum monostearate added could be given intramuscularly at intervals of about 48 hours. When aureomycin is used it should be given in the doses recommended for moderately ill patients. As sequestra and necrotic material are almost invariably present in this condition, and because of the nature of the infection, there is little chance that sterilization of the lesion can be accomplished by the administration of antibiotics alone. *It is of the highest importance that proper surgical attention be given to the patient by a competent oral surgeon.* This is not an infection with which to experiment. The oral surgeon should be consulted at the beginning of the process. If the extraction has been difficult and there is a possibility that a "dry socket" will result, a preparation of procaine penicillin G with crystalline penicillin G added, administered intramuscularly in aqueous suspension every 12 hours for at least 72 hours, should be used to combat the impending infection.

### *Periapical Infection*

The treatment of periapical infection and the problems involved in it are those of the treatment of an abscess or an infected cyst. The

infection may be caused by any one of, or a mixture of, the micro-organisms which inhabit the mouth.

*Treatment.*—In the conservative treatment of periapical infection, a rapid- and slow-acting preparation of penicillin containing 100,000 units of crystalline penicillin G and 300,000 units of procaine penicillin G, administered intramuscularly in aqueous suspension at intervals of 8 to 12 hours, is of value in bringing the infection to the point at which surgical intervention is indicated. This treatment should be continued for at least 48 hours after incision and drainage have been accomplished. Other methods of antibiotic therapy have been tried. The area of the infection has been infiltrated with an aqueous solution of crystalline penicillin G containing 2,500 units per cc., together with the injection of small amount of the solution of penicillin directly into the pulp canal of the diseased tooth. The flooding of the diseased root canal with solutions containing 50,000 units of crystalline penicillin G has been advocated. Dental paper points containing 3,000 units of penicillin have been used for shortening the time supposedly needed for sterilizing the root canals in the treatment of periapical infection. In addition, incision and drainage help to eliminate or localize the infection. Cold applications to the face and hot irrigations intra-orally comfort the patient and assist in bringing about a resolution of the infectious process.

It is probable that aureomycin given orally will prove to be of value in the control of periapical infection.

#### *Pericoronitis*

Acute pericoronitis is generally produced by one or a mixture of the normal bacterial inhabitants of the mouth. A penicillin ointment containing at least 1,000 units per cc. should be forced gently, through a blunted needle, between the erupting tooth and the soft tissue. This may be repeated as often as is considered necessary. Cold compresses applied to the face may reduce the pain incident to this infection.

#### *Periodontitis (Pyorrhea)*

The cause of pyorrhea is not definitely known, but vitamin deficiencies are believed to be a contributing factor. The secondary infection is produced by a mixture of the micro-organisms which inhabit the mouth. There is no specific therapy. Improvement may be noted if the teeth are thoroughly sealed and then penicillin packs with dry tinfoil are applied. If a vitamin deficiency exists, therapeutic doses of vitamin C and of the B complex should be given. Antibiotics do not cure pyorrhea. They may help to decrease the severity of secondary infection.

*Vincent's Infection*

While this disease may occur in endemic and epidemic forms, it is probable that it is not communicable in the ordinary sense of the word, and that, at least insofar as the endemic form of Vincent's infection is concerned, other basic causes are responsible. The exciting organisms are *Borrelia vincentii* and *Fusiformis dentium*. Other bacteria in the mouth may play some role in the production of the disease. The predisposing causes may be divided into those that are local and possibly those that are systemic in type. Among the supposed local causes are calenli, orthodontic appliances, metallic deposits, areas of occlusal overfunction, erupting of malposed teeth with gum flaps, overhanging gingival margins of fillings, ill fitting crowns, faulty restoration, and other results of poor dentistry. The systemic contributing causes include agranulocytosis, leukemia, aplastic anemia, certain vitamin deficiencies, and chronic malnutrition. Whenever possible, the local or systemic factors must be controlled if satisfactory results from antibiotic therapy are to be obtained and maintained. The local factors should always be corrected if possible by the dentist, and the dental officer in conjunction with the medical officer should attempt to correct adverse systemic factors which may play a role in producing this disease.

Penicillin is the drug of choice. Procaine penicillin G in doses of 300,000 units with 100,000 units of crystalline penicillin G added, in watery suspension, is given intramuscularly every 8 to 12 hours until the infection is controlled. Local factors which predispose the patient to this infection must be corrected.

**THE PROPHYLAXIS OF SYSTEMIC INFECTION IN DENTAL PRACTICE**

The mouth is teeming with many different species of bacteria. Teeth that need to be extracted are generally infected with one or more varieties of the bacteria of the mouth. At extraction, host-parasite relations are disturbed and, in many instances, bacteria pour into the blood stream. As a rule, this bacteremia is transient and does no harm, but in patients who have rheumatic or other types of heart disease, these circulating bacteria may settle on the heart valve and produce subacute bacterial endocarditis. Patients who have acute, subacute, or chronic nephritis may have a flare-up of their disease following the extraction of teeth, and patients with diabetes often react poorly after the same procedure. *The dental officer should inquire of every patient for whom an extraction is advised as to whether that patient has had rheumatic fever or rheumatic heart disease, degenerative heart disease, nephritis, or diabetes.* If the inquiry elicits a positive reply, the patient should be treated prophylactically with penicillin or aureomycin before and after the tooth is extracted.

**SUMMARY**

The treatment of dental infections has been revolutionized by the introduction of antibiotics. The dental officer should take full advantage of the benefits offered by these agents. In many instances, efficient treatment of infections of tooth and jaw structures is best achieved by a cooperative effort between the dental and medical officers.



# The Care of Premature Infants

JOHN C. W. CAMPBELL, Lieutenant, Junior grade (MC) U. S. N.

In the period from 30 April 1947 to 1 May 1948 there were 828 live births recorded at the U. S. Naval Hospital, Philadelphia, Pa. Of these births, 56 or 6.75 percent were classified as premature—prematurity being determined according to the resolution adopted in 1935 by the American Academy of Pediatrics (1):

A premature infant is one who weighs 2,500 gm. (5.5 lb.) or less at birth (not on admission) regardless of the period of gestation. All liveborn premature infants should be included, evidence of life being heart beating or breathing.

Fourteen premature infants did not survive beyond the tenth day: a mortality rate of 25 percent. The weight of these premature infants ranged from 364 gm. (13 oz.) to 2,380 gm. (5 lb., 5 oz.).

As shown in table 1, the greatest number of deaths were among those infants who weighed less than 1,500 gm. (3 lb., 5½ oz.). The lone survivor of this group weighed 952 gm. (2 lb., 2 oz.).

TABLE 1

Weight (grams)	Number of cases	Deaths	Mortality
Under 999	8	7	87.5
1,000 to 1,499	2	2	100.0
1,500 to 1,999	8	2	25.0
2,000 to 2,399	33	3	9.1
2,400 to 2,500	5	0	0
Total	56	14	25.0

There were 14 deaths in this series (table 2). Autopsies were performed in all except one. Immaturity, the most frequent cause of death, accounted for 6 fatalities. Intracranial hemorrhage accounted for 3 deaths; erythroblastosis fetalis caused 1 death; congenital heart disease, 1 death; intra-abdominal hemorrhage, 1 death; and pneumonia caused 1 death.

## CARE OF THE PREMATURE INFANT

The care of the premature infant begins at the time of the delivery. We believe that with the close cooperation of the pediatrician and

TABLE II

Case No.	Birth wt. (kg)	Pain and stiffness	Onset	Gestational age	Interpretation	Cause of death (autopsy)		Cause of immaturity		Evaluation
						Mother's blood Kahn test	Mother's Rh factor	Negative	Positive	
1	3.1 kg	-	1st	32 weeks	ABO	ABO	Positive	do	do	Normal
2	3.5 kg	-	1st	32 weeks	ABO	ABO	Positive	do	do	Normal
3	3.1 kg	1st	1st	32 weeks	ABO	ABO	Positive	do	do	Normal
4	3.1 kg	5 days	1st	32 weeks	ABO	ABO	Positive	do	do	Normal
5	3.1 kg	Myositis	1st	32 weeks	ABO	ABO	Positive	do	do	Normal
6	3.1 kg	Edema	1st	32 weeks	ABO	ABO	Positive	do	do	Normal
7	3.1 kg	3 days	1st	32 weeks	ABO	ABO	Positive	do	do	Normal
8	2.8 kg	5 days old	1st	32 weeks	ABO	ABO	Positive	do	do	Normal
9	3.1 kg	-	1st	32 weeks	ABO	ABO	Positive	do	do	Normal
10	3.1 kg	-	1st	32 weeks	ABO	ABO	Positive	do	do	Normal
11	3.1 kg	10 days	1st	32 weeks	ABO	ABO	Positive	do	do	Normal
12	4.1 kg	10 days	1st	32 weeks	ABO	ABO	Positive	do	do	Normal
13	4.1 kg	12 days	1st	32 weeks	ABO	ABO	Positive	do	do	Normal
14	6.1 kg	5 days	-	32 weeks	ABO	ABO	Positive	do	do	Normal

1. Evaluation of skimmed milk solution in utero, negative, entire胎兒羊水正常, and half full liver full  
 2. Majority of skimmed milk solution in utero, positive, entire胎兒羊水正常, and half full liver full

obstetrician the number of neonatal premature deaths can be kept at a minimum. It is the practice of this service to have the pediatrician notified of any pending premature birth, in order that he might be present at the delivery.

In those cases in which there is great difficulty resuscitating the infant, especially with the smaller premature infants, the pediatrician takes over the task of resuscitation if so desired by the obstetrician. Any mucus, amniotic fluid, or meconium is removed from the air passages by aspiration to provide an unobstructed airway. Since inspiration frequently occurs as the head is delivered the obstetrician should aspirate as much mucus as possible at this stage.

Following delivery, the infant is placed in a warmed blanket and if the respirations of the child are normal, the child is moved to a heated crib in the nursery. If further resuscitation is necessary, and there is an adequate air passage, oxygen by face mask is given. In cases requiring prolonged resuscitating efforts, the infant is placed in a tub of warm water with temperature between 95° and 100° F. (2) to maintain body heat, and to provide a means of establishing a contrast in temperatures, which frequently acts as a respiratory stimulant. This is accomplished by removing the child from the warm water to the air at room temperature, not by plunging the infant in a tub of cold water. In this way the body temperature is not lowered appreciatively, but the purpose is accomplished.

Upon their arrival in the nursery, all premature infants weighing 5 pounds or less are placed in a previously heated incubator with an oxygen content between 45 and 50 percent and a relative humidity between 70 and 77 percent (3) (4). Menadoine, 2.0 mg., is given intramuscularly on admission to the nursery to elevate prothrombin levels and to prevent cerebral and umbilical hemorrhages (5) (6) (7). The air passages are cleared if necessary. The authors do not believe that any of the respiratory stimulants are of great value in resuscitation of the newborn.

The incubator is kept at a temperature sufficient for the premature child to maintain as near normal a body temperature as possible. Hot-water bottles are used in conjunction with the incubator heat, if necessary. It is desirable to maintain the percentage of oxygen between 45 and 50 percent and the relative humidity between 70 and 77 percent (4). The higher percentages are used with the smaller infants. As the child's weight increases, the concentrations of oxygen and percentages of humidity are dropped. High concentrations of oxygen are best with high percentages of humidity (3) (8).

As soon as respiration is established, the premature child is left alone for from 12 to 24 hours (depending on weight) with minimal

handling. No clothing is used except for a loosely pinned diaper: clothing means frequent handling. The larger infants are given 5 percent dextrose in distilled water by mouth at 12 hours (4); the smaller infants proportionally later. The method of feeding, again depending on weight, is by nipple or by gavage, using hypodermoclysis, as a means of maintaining body fluid levels. The larger and stronger premature infants are breast-fed, with supplementary feedings if necessary. The amount of formula by mouth varies from 4 cc. every 1 to 2 hours to 30 cc. every 3 hours. An artificial formula is given 6 to 12 hours after the initial feeding of dextrose solution. At this institution, we use a prepared mixture of skimmed-milk solids, dextrins, maltose, corn oil, calcium caseinate, and halibut liver oil for feeding the premature infant.

When administering fluids by hypodermoclysis, 20 cc. per kg. (3 dl. per lb.) is given, using the back as the site of injection (9). It is desirable to give 165 cc. to 200 cc. per kg. (2½ to 3 oz. per lb.) of body weight as the total amount of fluids for a 24-hour period.

As soon as the infant is taking the 5 percent dextrose solution without difficulty, we start a dilute formula, giving approximately 45 to 65 calories per kg. (20 to 30 per lb.) of body weight. When the infant is able to tolerate it, an increased and more concentrated formula is given. We believe that a high caloric intake is of importance for the rapid growth and development of the premature child. Therefore, we frequently give formulas which contain as many as 210 to 264 calories per kg. (105 to 120 calories per lb.). By the second day of life we supplement the diet with vitamins, especially vitamin C, giving 50 to 100 mg daily (4) (10). As the premature infant grows older (age 21 days) we begin iron therapy in the form of elixir of ferrous sulfate (2).

A few days before discharge, the child is given an evaporated milk formula, using one part of evaporated milk to two parts of boiled water. The carbohydrates are supplemented by the addition of approximately 1 ounce of dextro-maltose. A water-soluble multivitamin preparation is added to one of the feedings. The child is fed every 3 to 4 hours as determined by weight and feeding demands. The discharge date depends on the progress of the infant and the home surroundings. The average premature infant is not discharged until it has reached a weight of 2,464 gm. (5 lb. 8 oz.). For those infants born of Rh negative mothers, a daily red blood cell count, hemoglobin, and a blood smear for immature red cells is done for the first 5 days of life, and then at weekly intervals until the child is 6 to 8 weeks old.

### COMMENT

Care of the premature infant demands special consideration and differs from the care required by full-term infants. Their environment and handling, as well as the special formulas necessitates close supervision and foresight on the part of the physician.

In a naval hospital, the rotation of nursery-room personnel requires that the handling of premature infants be standardized as closely as possible. With this in mind we have chosen a prepared mixture of skimmed-milk solids, dextrins, maltose, corn oil, calcium caseinate, and halibut liver oil as the simplest formula that possesses the nutritional value which the premature baby requires.

It has been shown in the studies of fat absorption by Tidwell et al. (11) (12) that olive oil and soy-bean oil are far more completely absorbed than butterfat. Further it has been observed that when these fats are substituted for butterfat, the weight gain is usually more rapid (11) (12).

In Adams' (13) series of 56 premature infants, who were given a simple evaporated milk formula, the average time required to regain birth weight was 12.5 days. In our series the average time required was 8½ days. This compares favorably with the grid as worked out by Dancis, O'Connell, and Holt (14) for recording weight of premature infants.

We believed that the ease in preparation of this type of formula is of advantage in that no great skill or complicated preparation is needed and yet standardized formulas are obtained.

The use of unmodified human milk for feeding, as shown by Gorden, Levine, and McNamara (4) does not give as rapid a weight increase as other types. Further, the necessity for collecting and pasteurizing human milk makes it less desirable than the use of readily available artificial formulas.

### CONCLUSIONS

1. The care of the premature infant begins at time of delivery.
2. Premature infants require an environment of high-oxygen content with suitable humidity and heat.
3. A high caloric intake is required for the growth and development of these infants.
4. Early addition of vitamins, especially vitamin C, to the diet of premature infants is of value.

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# Efficient Full Denture Service

Lynn C. DIENSEN, Colonel, DC, U. S. A.

THE technique herein described should enable the operator to establish a more accurate functional bite registration in the construction of full dentures. Assuming that accurate impressions are obtained and correct vertical dimensions recorded, this technique will reduce occlusal adjustments to a minimum thus saving time and providing the patient with an accurate balanced occlusion free from lateral interference. Inasmuch as the Hanau articulator is now a standard item of supply, it is suggested that it be used whenever possible.

## THE GOTHIC ARCH TRACING AND ITS APPLICATION TO DENTURE CONSTRUCTION

The anterior segment of the mandible will scribe a gothic arch as the head of each condyle separately rotates in the glenoid fossa while the opposing condyle travels downward and forward if this movement is started from a true centric relation of the mandible to the maxilla at a given vertical opening. A gothic arch with straight lateral markings results if this movement is begun at a given vertical opening and the condyles are in the most comfortable retruded position in the glenoid fossa from which lateral movements can be made. When such a gothic arch tracing is produced it indicates that the mandible is in proper centric relation to the maxilla. Correct centric occlusion occurs when the patient closes the jaws during swallowing and at the end of each masticatory stroke. If accurate centric occlusion is not registered on the articulator the mandibular and maxillary teeth will not interdigitate in correct centric relation resulting in occlusal interference and trauma to the supporting tissues. If occlusal interference of the teeth is present a sequence of events will be established which will produce the following disturbing results: (a) Impact shock will produce trauma; (b) trauma will produce inflammation; (c) inflammation will produce ridge resorption; (d) ridge resorption will produce additional unbalanced occlusion; and (e) this additional unbalanced occlusion will lead to more trauma. This trauma may result in an inflammatory reaction in the soft tissue followed by osteoclastic resorption of the alveolar bone. Tenderness beneath the denture may occur, necessitating frequent adjustments and early and frequent rebasing, all contributing to the dissatisfaction of the patient.

Balanced occlusion may be established during the anteroposterior excursions of the mandible by use of a protrusive check bite record established on the gothic arch tracing. This record will measure the approximate distance the mandible drops, in the posterior region, when the patient protrudes the mandible from 4 to 6 mm. Such a range of movement exceeds the distance the mandible travels during the actual trituration of food but the relations obtained will establish occlusal balance during and at the end of each protrusive to centric masticatory stroke. Protrusive records, when transferred to a semi-adaptable articulator, permit setting the condylar elements of the articulator at an inclination which approximates the inclination of the eminentia articularis. Dentures constructed from an accurate centric record with teeth articulated in conformity with the anatomic condylar inclinations should be in balance when the mandible is in the incisive or centric position. Thus trauma is reduced, the patient's comfort enhanced, and masticating efficiency improved.

Additional data are obtainable from the gothic arch tracing if the maximum in balanced occlusion, during all the excursive movements of the mandible, is recorded. Right and left lateral plaster check bites will contribute to balanced occlusion during all of the eccentric to centric movements of the mandible. Records obtained by these lateral check bites may be transferred to the articulator and incorporated into the denture. Thus, it is possible to eliminate all cuspal interference during the excursive movements of the mandible. Failure to duplicate Bennett movement and centers of rotation results in cuspal interference during both eccentric to centric occlusion. This is expressed in a lateral force that is transmitted to the alveolar ridge.

If the triangle A B G (fig. 1) represents the mandible in centric position with G being the centric position of the tracing stylus, the following observations can be made. Consider D, B, and F as three separate centers of rotation, one of which will be correct for the patient. If the distance between the condylar elements of the articulator were the same as the distance between A and B, or the patient's intercondylar width, then the center of rotation of the patient's left condyle would be at B and the arc BB' would be scribed when the patient moved the mandible into right lateral positional relationship. This case could then be transferred to the articulator and the same arch produced. The patient's intercondylar width and the distance between the condylar elements of the articulator are, however, rarely the same. The anatomic rotation centers may be at D or F and consequently arches DD' or FF' would then be scribed. If the center of rotation of the articulator is at B and the patient's centers of rotation at D or F, the cuspal paths on the articulator would not travel in the same arc when placed in the patient's mouth. Thus cuspal interfer-

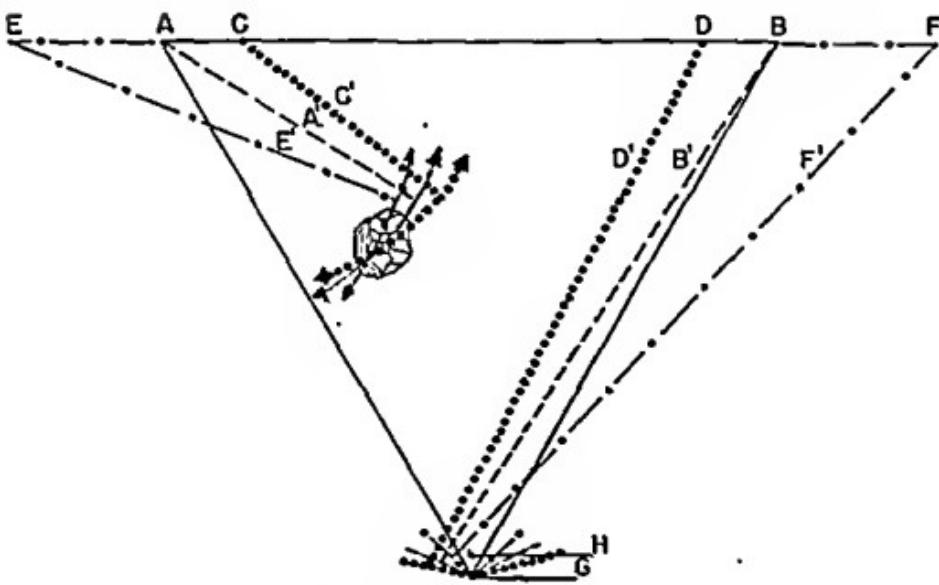


Figure 1.

ence would immediately occur when the mandible moved into lateral excursions. This is graphically represented by using E, A, and C as separate centers of rotation and EE', AA', and CC' as the paths produced by the mesiobuccal cusp of the lower right first molar. Note the different paths traveled by this cusp when E, A, and C, respectively, are used as centers of rotation. Certainly cuspal interference must occur when the center of rotation of the articulator and that of the patient do not coincide. There are additional factors such as Bennett movement that contribute to this error but they need not be considered here. The amount of cuspal interference that results when a base is constructed on a fixed articulator whose intercondylar width is different from that of the patient and with a centric relationship established at H instead of at G is obvious.

Lateral plaster check bites, when transferred to an adaptable articulator, will establish centers of rotation and Bennett movement on the instrument that are equivalent to those in the mouth. Dentures constructed on adaptable instruments from the check-bite records taken from gothic arch tracings will be more comfortable, more efficient, and less traumatizing than those constructed from haphazard mush bites and then made on a fixed articulator.

#### TECHNIQUES FOR OBTAINING JAW RELATIONSHIP RECORDS

##### I. ARBITRARY WAX RIM TECHNIQUE

**Procedure.**—This technique entails the construction of an upper and lower wax bite rim. The occlusal plane is established on the upper wax rim and the vertical dimension record is determined by softening

ing the lower wax rim and having the patient close into this softened wax until proper vertical opening is obtained. The wax rims are then chilled, the excess wax removed, replaced in the patient's mouth, and the patient closes in a relaxed position. Vertical marks are placed on the buccal and labial aspects of the wax rims and further checks made to determine whether the patient is in centric relation. With centric relation established as evidenced by the vertical lines on the wax rims, the wax rims are fastened in this position and carried to the articulator and mounted. The wax rims are then returned to the patient's mouth and a double thickness of softened wax placed on the lower rim and the patient instructed to protrude the mandible about one-fourth of an inch and close. The wax rims and wax protrusive bite records are returned to the articulator and the horizontal condylar elements set for steepness.

*Advantages.*—The advantages of this procedure are outweighed by the inaccuracies introduced at the time these records are taken, such as: (a) inaccurately fitting baseplates, (b) underextended baseplates, (c) overextended baseplates, and (d) insufficiently heated wax. Al-

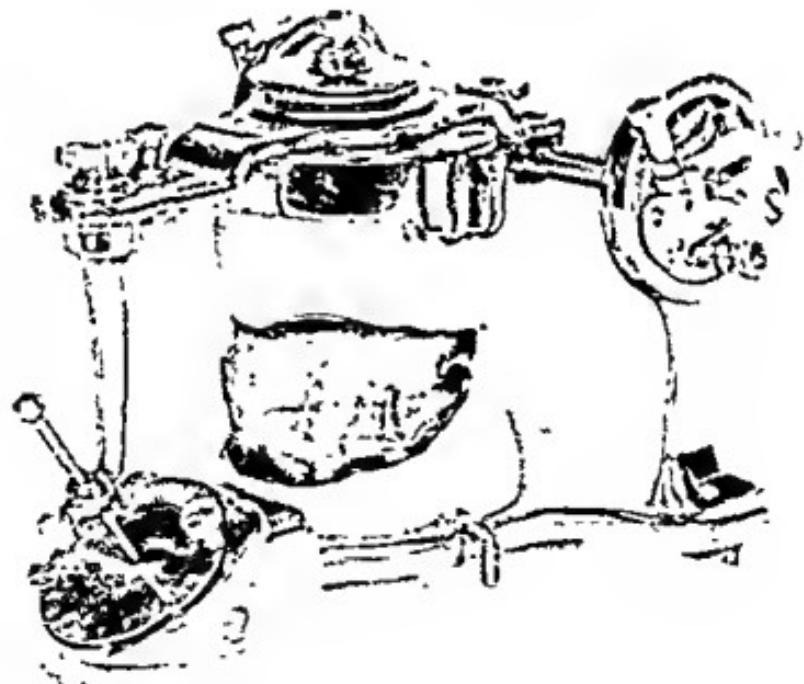
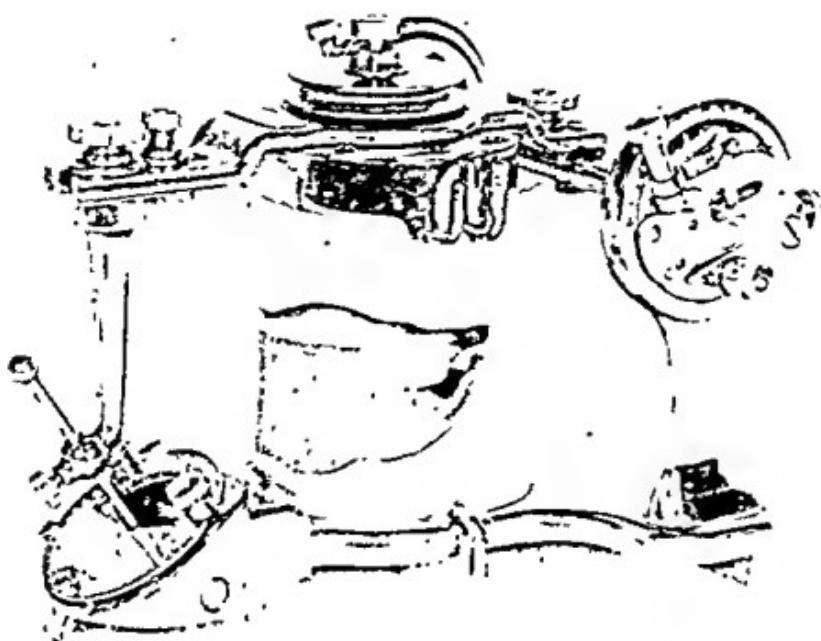


Figure 2.—Note defects in the baseplates and bite rims. The baseplates are not closely adapted to the casts. The posterior extremities of the baseplates are in contact. The lip contours were not established. The median line was not established. The centric lines in the posterior region are not well-defined.



*Figure 3.—These baseplates are accurately adapted to the ridges. The wax rims are neatly formed. The median line is established and lateral centric check lines are positive which facilitates their readability.*

though the procedure is not time consuming, accuracy instead of speed should be the goal at this stage.

**Disadvantages.**—The disadvantages of this method are (*a*) uneven pressure and displacement of ridge tissues and tissues in the condylar region caused by unevenly heated wax and subsequent pressure thereon, contributing to an overocclusion in the finished ease; (*b*) difficulty in getting the patient to relax and assume a true unstrained centric relation; (*c*) shifting the bases caused by the bulk of wax, poorly adapted baseplates, and uneven heating resulting in euspal interference in the finished ease (fig. 2); and (*d*) warpage of baseplates and subsequent shifting.

**Precautions.**—To obtain accuracy by this procedure, closely adapted reinforced baseplates are essential (fig. 3). Acrylic bases are preferable. A layer of soft wax placed on the occlusal surface of the wax rim at the time of establishing vertical dimension is advantageous in minimizing uneven pressures and shifting of the bases. The technique itself is contributory to carelessness because of its apparent simplicity.

## 2. EXTRAORAL TRACING TECHNIQUE

*Procedure.*—Wax rims are constructed and vertical dimension records taken as previously described, then some form of extraoral tracing device is attached to the labial and buccal surfaces of the wax rims and a gothic arch tracing is scribed by the patient. The wax rims are fastened together when the stylus of the tracing device is located on the apex of the gothic arch tracing. A reasonably accurate centric relationship record is thus obtained.

*Advantages.*—The chief advantage of this procedure is that the tracing is in plain view to the operator.

*Disadvantages.*—Anteroposterior and lateral displacement forces are introduced while having the patient scribe the gothic arch tracing. This displacement force is caused by the stickiness of the occlusal wax surfaces that are in contact during the various movements of the mandible. Uneven and bilateral pressures on the wax rims, during the centric and protrusive positions of the mandible, would compress the underlying tissues resulting in incorrect positional mounting in the articulator.

*Precautions.*—Wax should be softened uniformly and to sufficient depth to insure equalized pressure during the closing procedure. This is a most difficult step and entails the use of accurately fitting bases.

## 3. INTRAORAL TRACING TECHNIQUE

*Procedure.*—Wax bite rims are constructed and the vertical dimension record established. A tentative centric relationship record is secured and the casts mounted on an articulator. A central bearing plate, with marking stylus, is attached to the upper occlusal wax rim. A central bearing plate, less stylus, is mounted on the lower wax rim after about 4 mm. of the lower wax rim has been removed. The stylus is then turned, in or out, until it contacts the lower tracing table in accordance with the vertical dimension maintained by the mesial guide pin of the articulator. The lower tracing table is coated with wax, carbon, or tracing ink. The wax rims, with intraoral tracing plates attached, are returned to the mouth and the patient instructed to generate a gothic arch tracing by moving the mandible anteroposteriorly and laterally. Light pressure should be maintained between the tracing plates during these movements. After an acceptable gothic arch tracing has been generated, the lower wax rim and tracing are removed from the mouth and a clear acrylic plate attached to the lower tracing table over the gothic arch tracing. The hole in the acrylic plate is placed directly over the apex of the gothic arch tracing. This will register the centric position of the mandible. The lower wax rim and tracing table are returned to the mouth and the patient instructed to close into the hole in the clear plastic disk.

Fast setting plaster is placed or injected between the base plates that record this centric record. The lower case is remounted with the aid of this plaster centric record. The lower wax rim and tracing table is returned to the mouth and the patient instructed to close into a second hole in the acrylic plate. This second hole is drilled 4 to 6 mm. directly posterior to the centric hole. Plaster is again injected between the bases. This record is used to set the condylar inclinations of the articulator (fig. 4).

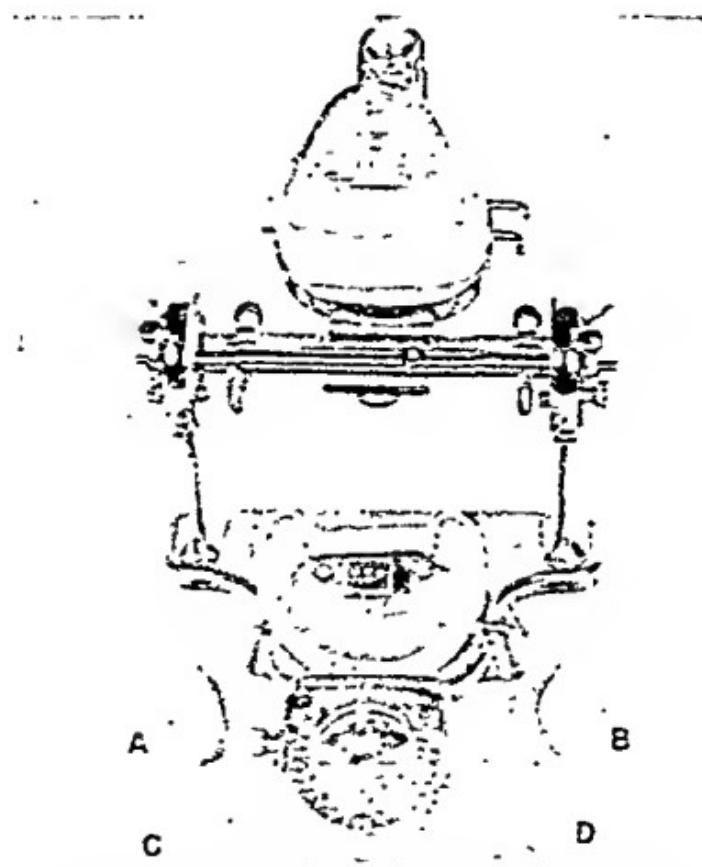


Figure 4.—Intraoral gothic arch tracing device. The four records obtainable are shown: (A) Right lateral record, (B) left lateral record, (C) centric record, and (D) protrusive record.

*Advantages.*—A gothic arch tracing is scribed with a minimum of lateral thrust and consequently a minimum of displacement of the underlying ridge tissues. The record is taken under central bearing point pressure that distributes the stresses more uniformly over the denture-bearing area. This limits lateral stresses and consequent errors caused by shifting of the bases.

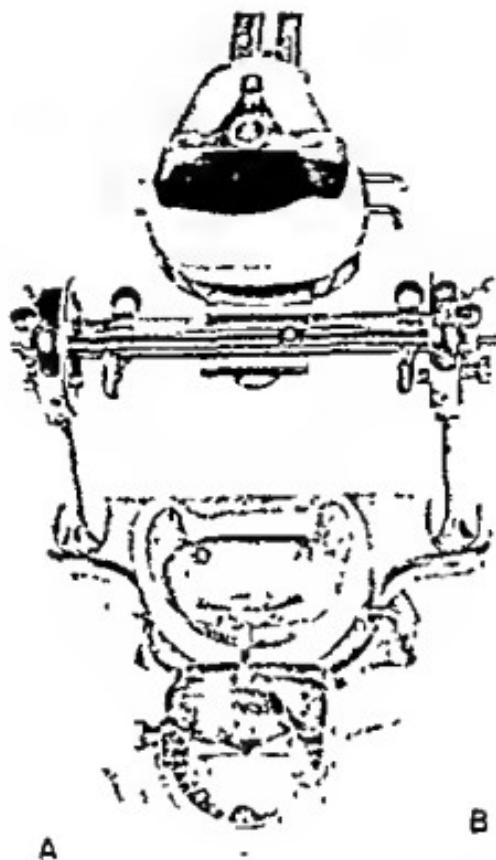


Figure 5.—One type of intra- and extra-oral gothic arch tracing device. Note blunt intraoral tracing stylus. (A) Centric record, and (B) protrusive record.

*Diseadantages.*—There is danger of the bases skidding on the tissues because the patient is locked in centric position in the hole of the acrylic plate. Unless the tracing stylus is mounted in the center of the denture bearing area, there is danger of the closing pressure tipping the lower base.

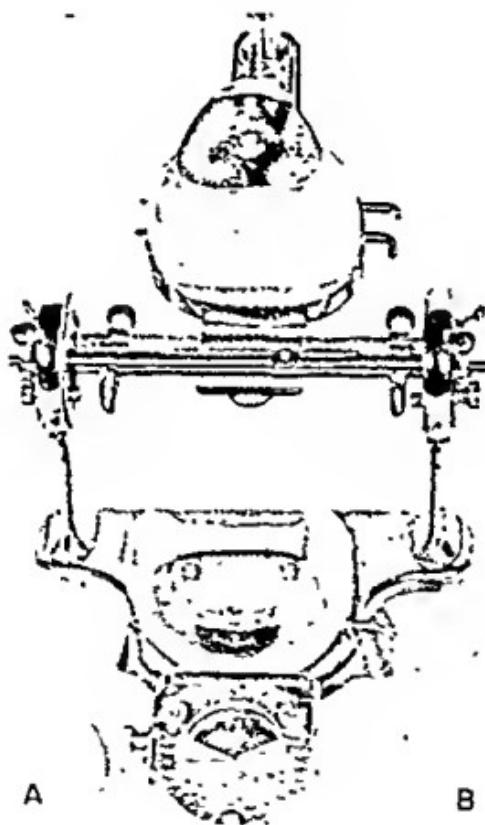
*Precautions.*—Obtain a gothic arch tracing that has a definite apex and straight lateral sides. A gothic arch tracing with other than straight sides indicates that the heads of the condyles are not in their proper centric position. Have the hole in the clear plastic plate definitely located over the apex of the gothic arch tracing and securely attached to the lower tracing table. The coating on the lower tracing plate must be thin and evenly distributed so that a clear definite tracing will be produced and so that the clear plastic plate will seat without rocking. Steel marking ink is an adequate material for this purpose. Have the hole in the clear plastic plate accurately drilled and of the same size as the tracing stylus so that movement will not be possible.

Inspect for clearance between the bases in the heel sections. Have the tracing plates mounted so that they are parallel to avoid tipping when the patient closes the jaws. Grease the lower tracing plate to allow for easy movement of the tracing stylus.

#### 4. COMBINATION INTRA- AND EXTRA-ORAL TRACING TECHNIQUE

*Procedure.*—The technique is the same as that of the two preceding methods except that they are combined. The intraoral tracing stylus is rounded to reduce frictional contact with the lower tracing plate and consequently to reduce shifting of the bases during the excursive movements of the mandible (*figs. 5 and 6*).

*Advantages.*—A gothic arch tracing is secured with a minimum of lateral thrust and consequently a minimum of displacement of the



*Figure 6.—A second type of intra- and extra-oral tracing device. The intraoral tracing stylus is blunt as shown in figure 5. The extraoral tracing device is a Gysi incisor path marker, with a fabricated metal tracing table. The three cone-shaped projections on the intraoral tracing device are used for reseating the plaster check bite records after these records have been formed. (A) Centric record, and (B) protrusive record.*

the operator to set the condylar guides of the articulator in an equivalent position.

*Disadvantages.*—The resistance to the three tracing studs offered by the lower compound rim may cause a lateral shifting of the bases and consequently contribute to an inaccurate record. The time element involved in chewing in the arrow-point tracings is lengthy. Patients with weak uncoordinated musculature may experience difficulty in cutting adequate arrow-point tracings. The procedure is quite messy from the standpoint of loose compound chips and debris that collect in the mouth during the operation.

*Precautions.*—Cutting studs must be sharp so they will cut the arrow-point tracings with a minimum of resistance. Accurate, well-adapted bases are essential. Arrow-point tracings must be well defined with sharp apices in order to contribute to an accurate centric relationship record. Patients must be instructed to chew rather than chop or holes will be made instead of arrow-point tracings.

#### TECHNIQUE ADVOCATED AND SERVICE RENDERED

To provide a technique for making more functionally accurate dentures, the following procedures were established, as an additional

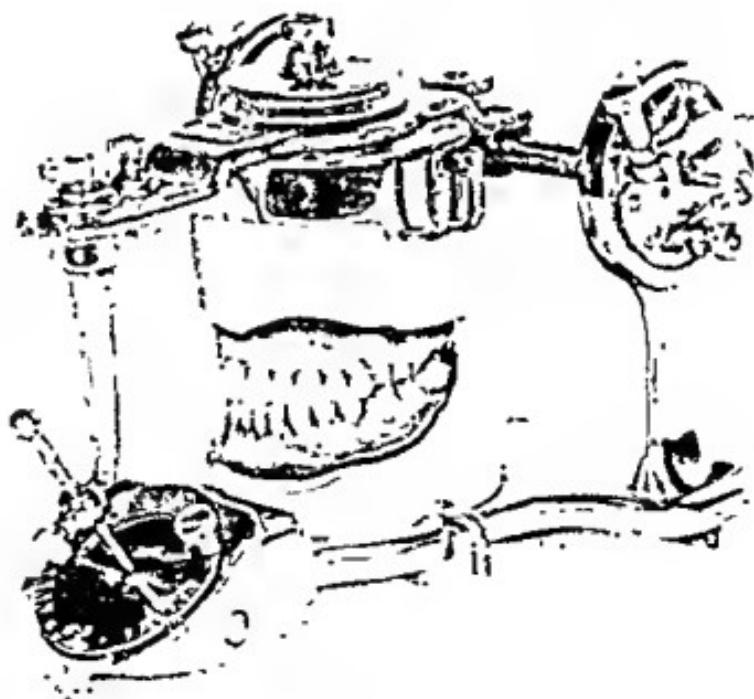


Figure 8.—Tentative set-up of the 12 anterior teeth and bicuspids on the original bases.

service to stations in the Fifth Army Area, by the Central Dental Laboratory.

#### STAGE I

*Station procedure.*—Impressions are taken, bite rims are constructed and vertical dimension records established in accordance with modern accepted procedures. Proper mold and shade of teeth are selected and the case is mailed to the laboratory.

*Laboratory procedure.*—The cases are keyed and are then mounted on an articulator. The anterior 12 teeth and bicuspids are set in position in the original wax rims in conformity with existing ridge relation (fig. 8). A second set of acrylic base plates are made. Intraoral tracing plates are correctly located and attached to these acrylic bases. The tracing stylus is turned up or down so contact with the lower tracing plate is made at the same time that the incisal pin of the articulator contacts its guidance. The lower tracing plate is coated with steel marking ink. A small vial of marking ink and brush are sent to the station with the set-up so that in case of error the plate may be repainted. A clear acrylic plate, with one hole drilled, also accompanies the case. A suitable container accompanies the trial set-up in which the operator places the plaster cheek bites when returning the case to the laboratory.

#### STAGE II

*Station procedure.*—The trial set-up is tried and critically judged for accuracy as to appearance, vertical dimension, and horizontal and vertical overbite. Any changes necessary are made at this time. The bases with the tracing plates mounted thereon are placed in the patient's mouth and an arrow point tracing is generated. If the arrow point tracing is accurate as to a definite apex and straight internal lines, the clear acrylic plate is luted to position over this tracing with the hole in the plate directly over the apex of the tracing. The bases are returned to the mouth and the patient is instructed to relax the mandible and close the jaws with the stylus seated in the hole in the acrylic plate. This gives the centric relationship record. A quick setting plaster is injected between the tracing plates or placed on the lower tracing plate prior to placing in position. This plaster cheek bite is marked "Centric relationship record." A second hole is drilled in the clear acrylic plate about 6 mm. distal to the first hole. This second hole, when recorded, gives the protrusive relationship record. The bases are again returned to the mouth and the patient instructed to protrude the mandible until the tracing stylus seats in the posterior hole in the clear acrylic plate. Fast setting plaster is again injected between the tracing plates or placed on the lower tracing plate prior to placing in position and this is recorded. This second

plaster check bite is marked "Protrusive relationship record." If the station desires to carry this procedure a step further and obtain the maximum in balanced occlusion two lateral plaster check bites are obtained. Two holes, one on either arch of the gothic arch tracing, about 6 mm. from the centric hole, are drilled in the plastic plate on the lateral lines of the tracing. Fast setting plaster is again injected as previously described. The trial set-up and plaster check bites are boxed and mailed to the laboratory.

*Laboratory procedures.*—The bases with the tracing plates are assembled with the centric plaster check bite and the lower case is remounted in the articulator (fig. 9). The protrusive and/or lateral plaster check bites are assembled between the bases and the condylar guidances of the articulator set to conform to these records. If lateral plaster check bites were taken, the case would be constructed on either a House or Stansbery articulator. The remaining teeth are set in position and articulated in accordance with lateral and protrusive movements generated by the articulator as set by the plaster check bites. The cases are waxed to anatomic requirements. The cases are split

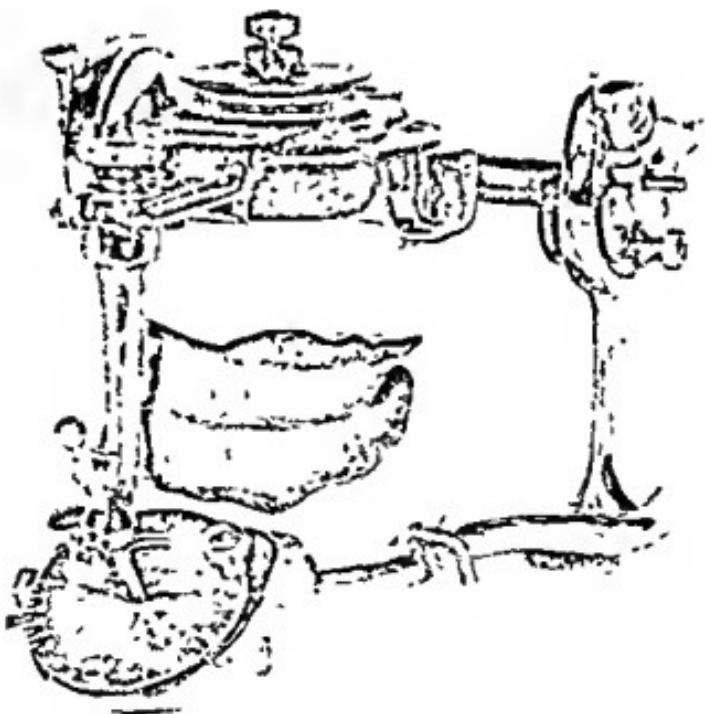


Figure 9.—Original bite rims placed in position on the casts after the lower case was remounted from the plaster check bite centric record. Note anteroposterior and lateral positional relationship error and separation of rims on the left side of the arch. This case probably would have to be reconstructed.

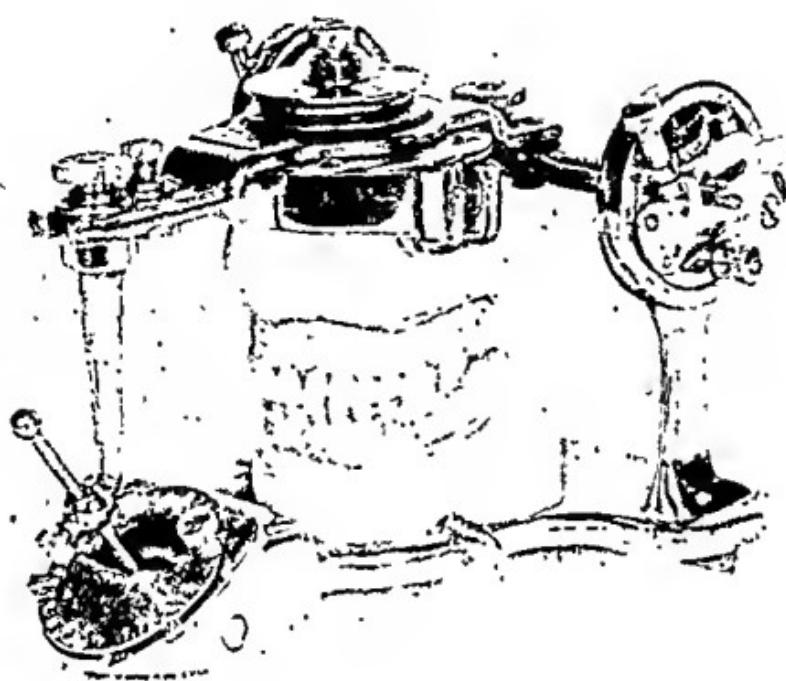


Figure 10.—Dentures fabricated on casts mounted in the articulator with the aid of an accurate plaster centric check bite record. These dentures have been worn for 8 months with only one post-insertion adjustment.

from the articulator, flasked, packed, and processed. Since the casts were keyed prior to mounting the ease in the articulator, the casts are reclaimed from the flask and remounted in the articulator for indiscriminate and selective spot grinding and the occlusion further refined by judicious milling-in on the instrument. This milling-in should be considered a preliminary refinement of the occlusion in that the main object is to remove processing errors (fig. 10). A wax cheek bite, and remounting of the ease for further milling should be accomplished after the dentures have been in service for several days.

Accurate centric relation and balanced functional occlusion are incorporated in full dentures constructed as here described. Such dentures will be free from all cuspal interference, and will eliminate many time-consuming post-insertion adjustments.

#### CONCLUSIONS

The principle of gothic arch tracings should be incorporated in the fabrication of more functionally accurate full dentures. The time saved on post-insertion adjustments together with the comfort and masticating efficiency the patient will enjoy, more than compensate

for the few additional minutes involved in obtaining centric and lateral check bite records. The bare minimum in technical procedure should include some form of the gothic arch principle if for nothing more than obtaining an accurate centric relationship record. This is essential since prosthodontists are charged with delivering to the patient the maximum in professional judgment and technical skill that modern dental science has to offer.



# Para-aminosalicylic Acid Resistant “Mycobacterium tuberculosis”

Incidence in Cases Treated at Fitzsimons Army Hospital

WILLIAM E. DYE, First Lieutenant, U. S. A. F. (MSO)\*

ELEANOR H. GOOLEY†

THE increased in vitro resistance to para-aminosalicylic acid (PAS) of *Mycobacterium tuberculosis* isolated from patients receiving the drug has been reported by several investigators (1) (2) (3) (4). This increase in in vitro resistance has been associated with loss of therapeutic effect of the drug in animal experiments (5).

This article presents the incidence and degree of in vitro resistance to PAS observed in cultures of *Myco. tuberculosis* isolated from patients treated at Fitzsimons Army Hospital. No attempts will be made here to correlate clinical response, toxicity, or pathology with development of bacterial resistance.

## METHODS

Detailed procedures for performing PAS sensitivity studies on *Myco. tuberculosis* are presented elsewhere (6). Cultures of *Myco. tuberculosis* were isolated in the usual manner, subcultured in liquid media, and then on a modified Herrold's egg-yolk agar containing 0, 1, 10, and 100 micrograms per milliliter of para-aminosalicylic acid (as the sodium salt). The sensitivity studies were evaluated after a 10- to 14-day incubation. Growth on the control tube was arbitrarily considered as 4 plus and growth on the other tubes evaluated in terms of the control. One to twenty-five percent growth on the control tube was reported as 1 plus, 26 to 50 percent growth as 2 plus, 51 to 75 percent growth as 3 plus, and more than 75 percent growth as 4 plus.

## RESULTS

PAS sensitivity studies were performed on one or more cultures from 303 patients who had not received the drug. Minor variations in sensitivity were observed with different strains of *Myco. tuberculosis*.

\* The Laboratory Service and the Research and Development Branch, Fitzsimons Army Hospital, Denver, Colo.

*lotis* and with different cultures from the same patient. The majority of the cultures produced from 0 to 3 plus growth on the 1-microgram per milliliter tube. A few produced as high as 4 plus growth on the 1-microgram per milliliter tube with a few colonies on media containing 10 micrograms of PAS per milliliter. In the absence of specific therapy, no increase in *in vitro* resistance was observed.

The results of the sensitivity studies of the first 37 patients to receive PAS therapy for 120 consecutive days at Fitzsimons Army Hospital are shown in table 1. Cultures from 6 of these patients were highly resistant to streptomycin. Because of the variation in growth on the 1-microgram per milliliter tube, only values on the control, 10- and 100-microgram per milliliter tubes were used to compile this table.

TABLE 1.—Analysis of *in vitro* resistance studies on *Mycobacterium tuberculosis* isolated from 37 patients receiving 120 consecutive days of PAS therapy

Patient	Total daily dose (grams)	Number of days after beginning therapy						
		0-30	31-60	61-90	91-120	121-150	151-180	181-210
1	+	+	+	+	R(10)	S(10)	R(10)	S
2	+	+	+	+	S	S	S	S
3	+	+	+	+	R(10)	R(10)	P(10)	R(10)
4	+	+	+	+	P	S	S	S
5	+	+	+	+	R(10)	R(10)	P	ND
6	+	+	+	+	P	S	S	S
7	+	+	+	+	R(10)	R(10)	S	S
8	+	+	+	+	S	S	S	S
9	+	+	+	+	R(10)	R(10)	S	S
10	+	+	+	+	R(10)	R(10)	S	S
11	+	+	+	+	R(10)	R(10)	R(10)	P(10)
12	+	+	+	+	R(10)	R(10)	R(10)	R(10)
13	+	+	+	+	S	S	S	S
14	+	+	+	+	R(10)	R(10)	R(10)	R(10)
15	+	+	+	+	S	R(10)	R(10)	R(10)
16	+	+	+	+	R(10)	R(10)	R(10)	P
17	+	+	+	+	P(10)	E(10)	P(10)	P
18	+	+	+	+	R(10)	R(10)	ND	ND
19	+	+	+	+	S	S	S	S
20	+	+	+	+	R(10)	R(10)	S	S
21	+	+	+	+	S	S	S	S
22	+	+	+	+	R(10)	R(10)	S	R(10)
23	+	+	+	+	R(10)	R(10)	S	R(10)
24	+	+	+	+	R(10)	R(10)	S	R(10)
25	+	+	+	+	R(10)	R(10)	S	R(10)
26	+	+	+	+	R(10)	R(10)	S	R(10)
27	+	+	+	+	R(10)	R(10)	S	R(10)
28	+	+	+	+	R(10)	R(10)	S	R(10)
29	+	+	+	+	R(10)	R(10)	S	R(10)
30	+	+	+	+	R(10)	R(10)	S	R(10)
31	+	+	+	+	R(10)	R(10)	S	R(10)
32	+	+	+	+	R(10)	R(10)	S	R(10)
33	+	+	+	+	R(10)	R(10)	S	R(10)
34	+	+	+	+	R(10)	R(10)	S	R(10)
35	+	+	+	+	R(10)	R(10)	S	R(10)
36	+	+	+	+	R(10)	R(10)	S	R(10)
37	+	+	+	+	R(10)	R(10)	S	R(10)

Explanation of code letters:

— Cultures where *in vitro* studies showed no growth on the 10-microgram per milliliter tube

— No cultures during period of evaluation

R — Cultures where sensitivity studies showed growth comparable to the control tube on the tube shown in parentheses following the symbol

P — Positive cultures during period of evaluation, but no sensitivity study was performed because of contamination or insufficient material

ND — No serum taken for culture during period of evaluation

\* Streptomycin-resistant

Analysis of table 1 reveals that 19 of the 37 patients yielded cultures resistant to 10 or more micrograms of PAS per milliliter during or after therapy. Seven of these patients now yield only cultures which are sensitive to PAS. In this series of patients there is no apparent correlation between total daily dosage or previous loss of streptomycin sensitivity and incidence of bacterial resistance to para-aminosalicylic acid.

### DISCUSSION

Additional PAS regimens are being investigated in the hope of delaying or preventing the emergence of bacterial resistance. Comparison with the data reported here will indicate the relative efficacy of these new regimens. At the present time the simultaneous use of PAS with streptomycin or other antituberculosis agents is receiving intensive investigation. Preliminary results (7) (8) show that the incidence of bacterial resistance to both drugs is greatly reduced by the practice of combined therapy. Intermittent administration of PAS alone, or preferably in combination with streptomycin, promises to delay the emergence of bacterial resistance compared to the rate with similar daily dosage regimens.

Bacterial resistance to PAS does not appear to be as permanent a phenomenon as loss of streptomycin sensitivity.

### SUMMARY

Cultures of *Myco. tuberculosis* from 303 patients who had not received para-aminosalicylic acid were uniformly sensitive to the drug. In vitro resistance to 10 or more micrograms of PAS per milliliter developed in cultures from 19 out of 37 tuberculous patients who received from 7.2 to 14.4 grams of the drug daily for 120 consecutive days.

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*Figure 5.—The line of incision for the columella flap is carried down to the columella cartilage. Intramarginal incisions are carried upward on each side of the columella in the mucosa.*



*Figure 6.—Columella flap elevated. The leaves of the medial crura of the lower lateral cartilages are separated by blunt dissection down to the nasal septum. The dorsum of the nose is undermined and the periosteum over the dorsum nasal bones elevated to provide contact of the bone graft with bone.*

the columella cartilage. Intramarginal incisions are then carried upward on each side of the columella in the mucosa. The columella flap is then elevated and dissected free from the medial crura of the lower lateral cartilages (fig. 6). This incision is practically invisible after healing because the shadow of the tip obscures the line.

With blunt scissor the soft tissue is freed over the nasal tip and lateral portions of the lower lateral cartilages. The soft tissue over the upper lateral cartilages is freed to release the depressed area and provide more room for the graft. The scissors are then carried over the nasal bones and straight to the root of the nose. A tunnel is formed. The periosteum is elevated over the dorsal ridge of the nasal bones and the radix nasi; thus permits the bone graft to seat directly in contact with the bone.

The columella is then undermined to the anterior nasal spine; this permits seating of the columella strut directly on bone.

A trial of the graft is then made and further adjustments on the graft performed. When a satisfactory fit is determined the graft is inserted in the prepared pocket (fig. 7) and the columella flap brought down into position. The flap is sutured with No. 00000 in-



*Figure 7.—Shaped bone graft ready for insertion into the dorsum of the nose.*

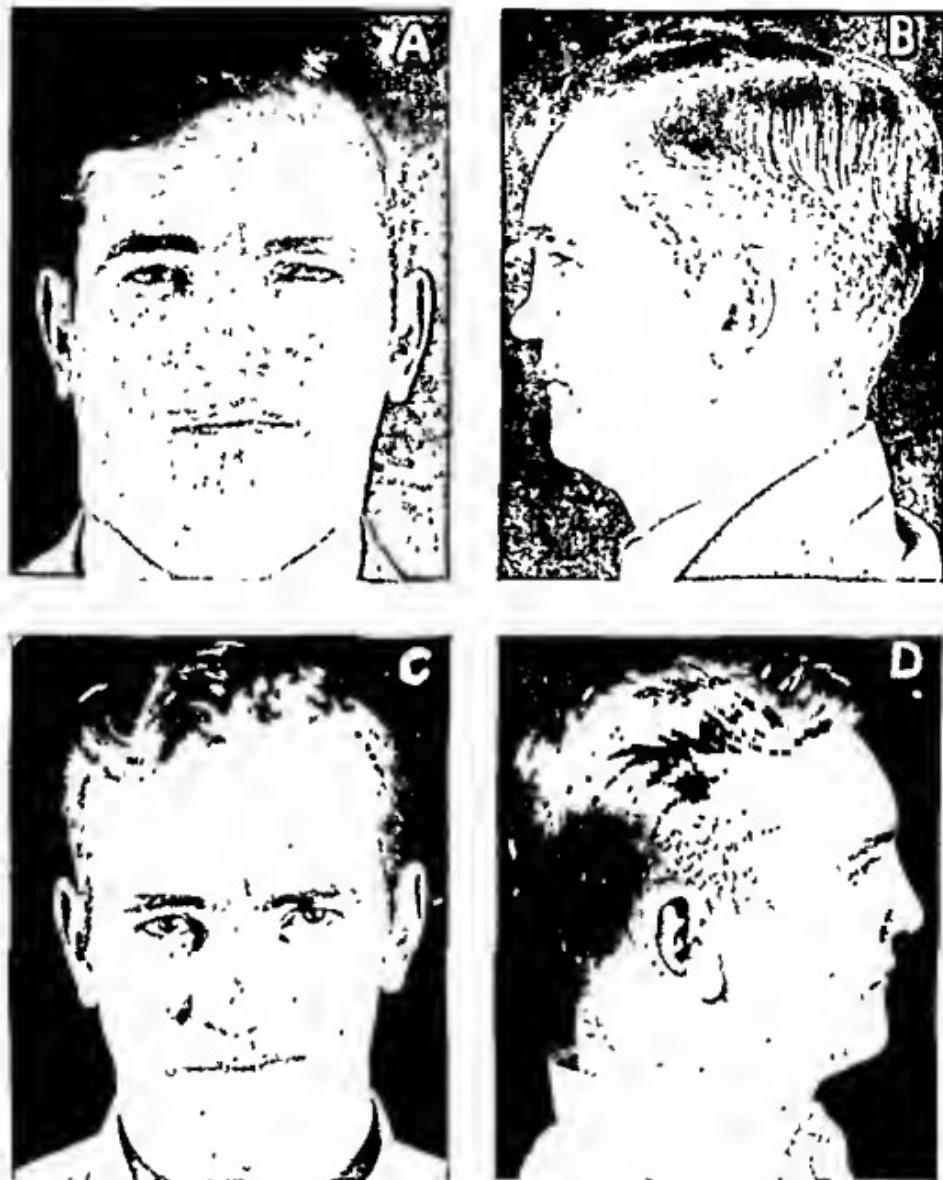


Figure 8.—Case 1. (A) and (B) Preoperative appearance, the result of nasal fracture. (C) and (D) Postoperative appearance. The nasal deformity has been corrected by an iliac crest cancellous bone graft in one continuous piece for the dorsum and columella. The contour is improved and the airways adequate.

errupted nylon sutures. The marginal incisions are closed. Nasal packs are placed lightly in the nostrils. Compound tincture of benzoin is used to cover nose, upper lip, and cheeks. A piece of soft cloth is cut to fit the nose. Adhesive strips,  $\frac{3}{8}$  inch by 6 inches, are used to cover the dorsum of the nose and hold the graft in position. As the tapes go into position, blood and swelling is milked from the nasal



Figure 9—Case 2 (A) and (B) Preoperative appearance, congenital saddle nose (C) and (D) Appearance after deformity had been corrected with cancellous bone graft

dorsum and strips of tape are brought around the under surface of the nose to reduce the width of the ala and increase the height of the nose.

Modeling compound is fitted over the nose, using the adhesive tape as a base. The compound is similarly secured with narrow adhesive tape to the nose and face. Particular attention is paid to bringing in the sides of the splint with adhesive tape to reduce the width of the

alae. The patient is placed on penicillin therapy for 6 days. Packs are removed in 48 hours. The nasal splint is removed in 7 days.

Figures 8 and 9 show preoperative and postoperative appearance of two patients.

#### CONCLUSION

Bone grafts to correct saddle-nose deformities can be secured in sufficient quantity from the iliac crest. These grafts are resistant to infection and provide a stable, easily worked material. Bone grafts hold the contour of the nasal dorsum more accurately than cartilaginous grafts. There is very little contracture and practically no loss of substance in the graft. The percentage of "takes" is uniformly good.

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9

# Prosthodontia in Diastema

W. IRWIN GULLETT, Lieutenant Commander (DC) U. S. N.<sup>1</sup>

**A**N EXAMPLE of using prosthetics to correct a fault that ordinarily would have to be corrected surgically or by orthodontics is presented.

## CASE REPORT

A routine dental check-up of a 33-year-old officer revealed a very wide diastema between the upper central incisors (fig. 1). He had discussed this anomaly with dentists from time to time but none had offered any hope of correcting the defect.

The space between the incisors (using a Boley gauge) measured 5.4 mm., the width of the central incisors was 8.4 mm. This gave a combined space of 22.2 mm. To put three teeth in the space instead of the two that were there, each tooth would have to be 7.4 mm. wide. This would be 0.6 mm narrower than the narrowest average central incisor.<sup>2</sup> It appeared possible to accomplish this and have an agreeable end result.

The first step was to take full-month impressions and run up some models in stone. The central incisors were then roughly prepared on the models as they would be if plastic jackets were going to be made. Blue casting wax was then applied to the pegs and a complete wax bridge was carved, filling the space across the anterior region. This step of constructing study models is very important before undertaking difficult and unusual cases because it indicates whether the end result will be satisfactory. From the model it was apparent that the space would take three teeth and give a good esthetic result.

Full jacket preparations were cut on the two central incisors (fig. 2); copper band impressions taken of the two preparations, and a full upper impression in "hydrocolloid" was made. The copper band impressions were then poured up in amalgam; the resulting dies were inserted in the "hydrocolloid" impressions and the whole poured in stone. The shade, both incisal and gingival was carefully selected at this time.

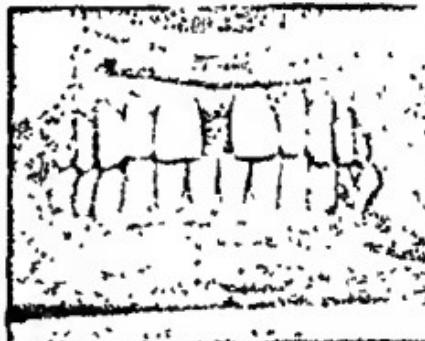


Figure 1.—Wide diastema between upper central incisors.

<sup>1</sup> U. S. Naval Air Station, Lakehurst, N. J.

<sup>2</sup> Black, G. V.: Descriptive Anatomy of the Human Teeth.



Figure 2—Full jacket preparation of upper central incisors.



Figure 3—End result.

The ridge between the incisor preparations was next relieved on the cast. Blue casting wax was then applied and the bridge, which consisted of two jackets and the middle dummy, carved. The usual procedures were followed in the curing and finishing of the all-acrylic bridge.

The end result (fig. 3) was very gratifying to the operator and the patient thereby became psychologically better fitted to perform his duties.

# Exfoliative Cytology Service in an Army Hospital

JOE M. BLUMBERG, Lieutenant Colonel, MC, U. S. A.<sup>1</sup>  
JANICE SUPKE, B. A.<sup>1</sup>

THE method of exfoliative cytology first introduced by Papanicolaou for the diagnosis of cancer has found wide application.

Its main value lies in its potentialities of diagnosing cancer in parts of the body ordinarily inaccessible and also in the detection of cancer in the subclinical phase. Its value in the diagnosis of bronchogenic cancer by sputum and bronchial aspiration is now well-established. Although the recognition of cancer cells in pleural and abdominal fluids, gastric washings, urine, and prostatic secretions is more difficult, the number of cases detected justifies the use of this method. A recent modification of the procedure has increased the percent of cases diagnosed from examinations of gastric washings.

## ORGANIZATION

The fundamental factor for the detection and final diagnosis of cancer is the continued observation of the patient and close collaboration of the attending physician, pathologist, and cytologist. In an Army hospital, where both patients and staff are subject to transfers, certain measures are necessary to insure the follow-up of each patient. In each department concerned with the various phases of the detection and diagnosis of cancer, in addition to the patient's clinical record, a special index is maintained in which every transfer of the patient is registered. Notification for a follow-up examination is sent either to the patient or to both the patient and the attending physician at the Army hospital nearest the patient's new address. This is particularly important in cases in which there are cells in the smear of equivocal nature and also in patients who require periodic examinations extending over months or years. The same applies to patients in whom a positive smear was followed by a negative biopsy report and repeated smears and biopsy examinations were advisable. All doubtful cases are reviewed and discussed with a consulting cytologist.

<sup>1</sup> Oliver General Hospital, Augusta, Ga.

### PROCEDURE

Exfoliative cytology was used at this hospital for the past 2 years as a part of the routine physical examination of all patients; the patient not knowing for what purpose this examination was being made. At no time was it referred to as a "cancer test" in the presence of the patient. It was used as a screening test for the detection of early, clinically unrecognizable cancer in women without gynecologic symptoms, as well as in women who presented some specific complaint and in cases of suspected cancer in parts of the body other than the cervix uteri. For the detection of cervical cancer the equipment consists of swabs, numbered slides, and cards for adequate informative history on one side, the other side being used for the pathologist's report. The fixative consists of equal parts of 95 percent alcohol and ether in Coplon jars. These are placed in wire baskets throughout the hospital.

### METHOD

A swab is inserted about one-half inch into the cervical canal and the junction of the squamous and columnar epithelium is carefully swabbed. The applicator is then rolled onto a clean glass slide and immediately placed in the fixative before drying has occurred. The smears should be fixed for at least 10 minutes and may remain in this solution up to a week, after which they are stained by a modification of Papamicolau's procedure and mounted with clarite. Douching or bathing, preliminary pelvic examination, or the drying of the smear before fixation are avoided. Performance of any one of these procedures may affect the characteristics of the secretions and may cause distortion of the cells. A screening technician systematically examines the entire slide of each vaginal and cervical smear, and marks the slides for further study by the pathologist. The interpretation of the slide requires extensive knowledge of exfoliative cytology. The appearance of the entire slide is important as the presence of erythrocytes or leukocytes, evidence of physiologic changes, pregnancy, radiation, and/or the menopause, should all be considered.

Smears from other body fluids are made when the symptoms suggest the presence of cancer in a part of the body inaccessible to other diagnostic procedures, or in a patient in whom metastatic cancer requires a search for the primary lesion. The sputum is collected in a jar containing 70 percent alcohol and sent to the laboratory. Bronchial aspirations are placed in 95 percent alcohol and sent to the laboratory. The first specimen of gastric fluid should be the fasting gastric content aspirated through a size 14 Levin tube, after the patient has drunk water. When the stomach has been emptied, it is washed by forcibly injecting 100 cc. of saline solution, aspirating,

reinjecting and aspirating a few times. During this procedure the patient should change position several times and be allowed to get up and walk. The saline washings constitute the second specimen. The sediment from pleural and abdominal fluids is mixed with a double volume of 95 percent alcohol and sent to the laboratory. Prostatic secretion obtained by prostatic massage is collected in a container or on a clean slide which is fixed in ether-alcohol or 95 percent alcohol and sent to the laboratory. Catherized urine is mixed with an equal volume of 95 percent alcohol and sent to the laboratory. All centrifuged sediments are placed on slides previously spread with Mayer's albumin glycerol. Smears of all body fluids are fixed for 1 hour in equal parts of 95 percent alcohol and ether and stained by the Papanicolaou method or with hematoxylin and eosin.

Since the adoption of this method, it was possible to detect cancer that would have otherwise remained unrecognized because other diagnostic procedures gave negative results. The final diagnosis of cervical cancer is never made from exfoliative cytology alone. When abnormal cells or cells with malignant characteristics are seen, another smear is usually obtained just prior to obtaining a specimen for biopsy, endocervical curettage, and endometrial scraping. Each positive smear must be confirmed by paraffin sections from cervical specimens for biopsy before a diagnosis of cancer is made. When the biopsy report is negative in the presence of a positive smear, the patient should be observed by repeated smears, preferably taken during the menstrual phase. If subsequent smears are positive, additional specimens for biopsy are obtained. Following a tentative diagnosis by exfoliative cytology in the presence of a negative biopsy report, repeated smears are indicated, and, before clearance is given, at least three smears should be free of cancer cells.

## RESULTS

In the past 2 years about 6,000 patients were examined by this method and 35 cases of unsuspected cancers were detected. We believe that these results justify the use of this procedure as a part of the routine physical examination.

## DISCUSSION

Exfoliative cytology is of value in the detection of preinvasive cancer of the cervix and as an adjunct to the diagnosis of cancer in other parts of the body. To train technicians to read the slides requires a minimum of 6 months' instruction, preferably in a recognized cytopathologic center where a large volume of material is available for study. This should be followed by extensive practice. Any training period

In penicillin we do not have the sovereign remedy: all things will not yield to it; it has failed to become the substitute for the thought and drudgery necessary to evaluate the patient's complaints.



# Spontaneous Pneumothorax

## Observations on Twenty-six Cases

ROBERT K. MOXON, Lieutenant (MC) U. S. N.<sup>1</sup>

**S**PONTANEOUS pneumothorax is not a common condition, nor is it important statistically as a cause of morbidity or mortality. For example, in 1945 when the Navy and Marine Corps had a peak average strength of 3,673,855, the diagnosis of pneumothorax was made only 651 times (1). However, 65, or 10 percent, of these cases were readmissions; 83, over 12 percent, were invalidated from the service; and 6 died.

As medical officers in the Armed Forces, we are in a position to observe far more than the usual number of patients presenting this syndrome since the age and sex incidence in this condition coincides precisely with that group of patients with whom we are most likely to come in contact, healthy young men.

There are two opinions concerning the pathogenesis of spontaneous pneumothorax. One is that of Macklin (2), who was able to demonstrate in animals that artificially induced elevation of intrabronchial pressure produced small but widespread rupture of the bases of the alveoli overlying the finer ramifications of the pulmonary vessels. This air gradually crowds into the sheaths of the larger blood vessels at the base of the lung and into the mediastinum, with the production of pneumomediastinum and, secondarily, through rupture of the visceral pleura, of pneumothorax.

The interrelationship of pneumomediastinum and pneumothorax has been demonstrated clinically, the most recent report being that of Dickio (3), who, in 20 university students, demonstrated pneumothorax alone in 6, pneumomediastinum alone in 7, and both conditions concurrently in the remaining 7.

The second view concerning pathogenesis is that of Ornstein and Lereher (4), who demonstrated fluoroscopically the sudden disproportionate overventilation of the lung apices when expiration was forced against the closed glottis (the Valsalva maneuver). They believe that apical overdistention, if repeated, could easily result in

<sup>1</sup>U. S. Naval Hospital, Philadelphia, Pa.



# Pediatric Excretory Pyelography

GLADEN R. HAMILTON, Lieutenant Colonel, MC, U. S. A.<sup>1</sup>

CHARLES A. DEKOVESSEY, Captain, MC, U. S. A.<sup>2</sup>

**B**ECAUSE of the large amount of intestinal contents overlying the kidneys and ureters, adequate visualization of the renal collecting system by excretory pyelography in infants and small children is difficult. Matthei<sup>2</sup> has presented a method which re-



Figure 1.—Pyelogram taken with conventional technique showing obscuring of dye by overlying intestines.

<sup>1</sup> Brooke Army Hospital, Fort Sam Houston, Tex

<sup>2</sup> MATTHEI, L. P.: Improved pediatric excretory pyelography. J. Urol. (in press)

moves much of the difficulty previously encountered. The simplicity of his procedure is striking, and is the result of the adaptation of the incidental finding of excellent roentgenograms taken when the child had been inadvertently fed immediately prior to radiographic study. His method is essentially as follows: (a) Withhold fluids for 12 hours prior to pyelography. (b) Inject 10 cc of contrast agent intravenously, even in small infants; the dose may be adjusted for older children, and the intramuscular route, though less satisfactory, may be used. (c) At the time of injection of dye, give the infant a full 8-ounce feeding; older children may be given two glasses of chocolate milk. (d) Between pictures, keep the infants in a nursery cradle with the foot elevated, constituting a modified Trendelenburg position.

The rationale of this procedure is based on the transverse position of the stomach in the infant or small child. When filled with liquid, there is a homogeneous relatively radiolucent large oval area overlying the normal position of the contrast agent through displacement of the intestines. Figure 1 shows a roentgenogram taken 25 minutes



Figure 2.—Pyelogram taken 5 minutes after injection of dye in patient whose liquid-filled stomach has displaced the intestines.

after the injection of the dye in a 20-week-old infant without feeding at the time of dye injection. The inadequate visualization of the renal collecting system is noted. Figure 2 shows the easy visualization of the renal collecting system with a liquid-filled stomach. We have used this method 4 months and the increased diagnostic value of excretory pyelograms in infants and small children in this period has been gratifying. In some roentgenograms, when the concentration of the dye was slight and when the films were unsuitable for photographic reproduction, the contrast has been entirely adequate for diagnostic interpretation. This method is recommended for general use.





# Treatment of Intolerance to Quinacrine

JOSEPH E. SOKAL, Lieutenant Colonel, MC, U. S. N. G.<sup>1</sup>

QUINACRINE in doses of 0.1 grain daily was well tolerated by most troops in malarial areas. A small percent of the personnel reported unpleasant symptoms, usually gastrointestinal, when suppressive therapy was started. When quinacrine was given in spite of these usually mild symptoms, tolerance was quickly established and suppressive doses could be maintained indefinitely without further difficulty. A much smaller number of men, after ingestion of quinaerine, had severe symptoms that became intensified rather than diminished with further doses. Attempts to continue administration of the drug to such men produced severely ill soldiers who often refused further medication even when threatened with court martial. These men were considered permanently intolerant to the drug and the use of suppressive doses of quinine was authorized for such personnel.

The opportunity to observe the reactions of hardened troops to quinaerine occurred when an infantry battalion, after 2 years of duty in nonmalarial areas of the Central Pacific, was ordered to the South Pacific and antimalarial therapy was started. The troops were given 0.1 gram of quinacrine daily and were informed that a small percent might have gastrointestinal symptoms for the first few days but that these would disappear after several doses of the drug. The tablets were swallowed under the supervision of an officer and a company aid man. The aid men reported that a moderate number of men complained of symptoms referable to quinacrine ingestion in the first week. Only a few of these men were seen in the battalion aid station, all with one or more of the following symptoms: nausea, vomiting, abdominal cramps, or diarrhea. These men were reassured and instructed to continue taking the drug. A few were given 1 or 2 doses of tincture of belladonna or paregoric to control their symptoms. After the first week there were no complaints, with the exception of the cases herein discussed.

<sup>1</sup> Laboratory of Pathology, Yale University School of Medicine, New Haven, Conn.

Two men reacted to quinacrine in a manner quite different from those previously mentioned and were considered to belong to the group for which transfer to quinine suppressive therapy was authorized. The criteria used to place these men in a separate category were (a) a reaction to quinacrine severe enough to render them totally unfit for duty and to require medical attention, and (b) an increase in the intensity of symptoms with successive doses of the drug—in contrast to the usual course of events. Both men were in good health and were responsible and stable members of the organization, having served with distinction through two campaigns. Psychic factors were not believed to be responsible for their atypical reactions. Because of the anticipated difficulty of maintaining and supervising proper quinine dosage in future combat situations, it was decided to attempt to overcome the intolerance of these two men to quinacrine. It seemed possible that adaptation might take place in these men, as in others, if the drug could be administered and retained for a reasonably long period. In order to make this possible, prophylactic treatment against the expected signs of intolerance was begun before starting administration of the drug. The object was to paralyze the mechanisms whereby intolerance was manifested, then to administer quinacrine, and maintain the inhibition of anticipated symptoms until it could be assumed that adaptation had taken place. This was accomplished in both cases and the method was later successfully applied to a naval officer.

#### CASE REPORTS

**Case 1**—A 20 year-old supply sergeant started quinacrine medication while at a beachhead supply dump. On the first day, he noted abdominal discomfort. Nausea and diarrhea appeared the second day and on the third day the diarrhea became severe and he vomited. He then reported to a medical officer at the beach, who discontinued the quinacrine, waited several days for symptoms to subside, and then attempted desensitization with fractional doses of the drug, starting with one-quarter of a tablet. Symptoms of intolerance immediately reappeared, in an even more severe form. The diarrhea was incapacitating by the second day and was associated with vomiting. The attempt was abandoned on the third day when repeated vomiting prevented retention of the administered dose. The soldier was then given a supply of quinine, which he took daily without any signs of intolerance.

On moving up to the battalion area, this soldier reported to the aid station for a resupply of quinine. He was persuaded to undergo a final attempt at overcoming his intolerance to quinacrine. Four cubic centimeters of paregoric and 15 drops of tincture of belladonna were given 4 times daily for 2 days. On the morning of the third day he complained of constipation and dryness of the mouth. He was then given one-quarter tablet of quinacrine and, because of obvious apprehension 0.1 gram of phenobarbital. He had one loose stool that morning and complained of some abdominal uneasiness. Belladonna and paregoric therapy were continued and two additional doses of 0.03 gram of phenobarbital were given that afternoon and evening. On the next day one-quarter

tablet of quinacrine was again given and the other medication was continued. He had no bowel movements or nausea that day and complained of drowsiness. On the fifth day, the dose of phenobarbital was reduced, only two doses of paretic were given, and one-half tablet of quinacrine was administered. He had one soft stool. Sedation was discontinued on the sixth day but the other medication was maintained. On the sixth and seventh days, one-half tablet of quinacrine was given. On the eighth day, 5 days after starting the quinacrine, 1 tablet of quinacrine and 1 dose of belladonna and paretic were given. Auxiliary medication was then discontinued and this soldier took 1 tablet of quinacrine daily without further evidence of intolerance.

**Case 2.**—A 38-year-old battalion commander started quinacrine medication when he returned to the organization after recovery from his combat wounds. Three to four hours after taking his first dose, he became nauseated, vomited several times, and complained of mild diarrhea and cramping abdominal pain. This reaction occurred at a regimental officers' party where he had consumed a large quantity of whisky, and the true cause of his symptoms was not realized. Two days later, he took another tablet of quinacrine and had a more severe attack of vomiting and diarrhea than on the first occasion. He then refused to take any more quinacrine.

Three weeks later he was persuaded to try to increase his tolerance to the drug. Four cubic centimeters of paretic and 15 drops of tincture of belladonna were given every 4 hours, starting at noon. With the fourth dose at midnight, one-quarter tablet of quinacrine was given. At 0200 he had a watery stool and mild nausea. One-tenth grain of scopolamine was given at this time and the patient spent an uneventful night. On the second day, after similar preparation, he asked to be given one-half tablet of quinacrine at midnight, and took this larger dose with impunity. On the third day, his medication was changed to 1 motion sickness preventive (MSP) capsule every 4 hours because of favorable experience with this compound in treating nausea and vomiting unassociated with motion sickness. One-half tablet of quinacrine was again taken with impunity. On the fourth and fifth days, MSP capsules and 1 tablet of quinacrine were given. The patient's stools were normal and there were no untoward symptoms. On the sixth day, auxiliary medication was discontinued and daily doses of quinacrine were taken from then on without evidence of intolerance.

**Case 3.**—A naval medical officer on transport duty requested advice regarding one of the ship's officers who had severe nausea and moderate vomiting, without diarrhea, following the taking of quinacrine. Two attempts to administer the drug had been unsuccessful, in spite of the officer's wholehearted cooperation. The suggestion was made that MSP capsules be administered every 4 hours during the day and that quinacrine be given on the second day, with an initial dose of one-quarter tablet. This was done, and the dose of quinacrine was gradually increased on successive days. At the end of a week the officer was taking 0.1 gram of quinacrine daily without auxiliary medication and with no untoward symptoms.

#### DISCUSSION

The cause of intolerance to quinacrine is unknown. It does not appear to be an allergic phenomenon. In many cases a distinct psychic influence has been implicated. It is generally agreed that, with few exceptions, if a man can be persuaded to take the drug regularly for a short time, symptoms of intolerance will disappear. The experience reported here suggests that tolerance can also be developed in many of

these exceptions. Whether it would be possible to overcome all intolerance to the drug cannot be stated on the basis of such a limited experience. Although this series is small, it includes all of the cases meeting the criteria for the discontinuance of quinacrine administration seen, and there were no failures. The successful results reported here were not considered to be the effect of psychotherapy. In the absence of any clear understanding of the mechanisms of intolerance to quinacrine, it is only possible to speculate as to why the treatment described gave such satisfactory results. Two factors are thought to be responsible. First, it may be assumed that a relatively stable, gradually increasing, tissue concentration of the drug was eventually attained in the treated cases. Such a state must be much more conducive to the normal process of adaptation to the drug, than the widely fluctuating concentration curve that is probably to be found in the person who has violent gastrointestinal reactions soon after ingestion of quinacrine. Second, by inhibiting the symptoms of intolerance, the establishment of an intense conditioned response to the drug is avoided. The technique used in these cases should be generally applicable to similar problems with other therapeutic agents. Limited experience in a civilian general hospital suggests that this is the case.

# The Early Diagnosis of Trachoma<sup>1</sup>

ADALBERT FUCHS, M.D.<sup>2</sup>

**A**LTHOUGH there are not many patients with trachoma in the United States, physicians in the Armed Forces may see such patients in the Pacific or in the Far East. Before World War I there were many patients with trachoma in Vienna, most of whom came from Hungary and Galicia. At one time there were so many patients with trachoma in the eye clinic, that my father, Ernst Fuchs, founded a special section consisting of an outpatient department and a 30-bed ward for them. In this section, special facilities for washing were provided to prevent the spread of infection by wash-basins and towels.

At that time much discussion about the diagnosis of trachoma resulted from the fact that many patients, especially school children, were seen with a slight conjunctivitis and a large number of follicles in the lower retro-tarsal fold. These follicles resembled the nodules of trachoma. Schnabel maintained that those patients had trachoma, while my father and many others stated that these follicles were caused by follicular conjunctivitis and had nothing to do with trachoma, because with proper treatment these follicles promptly disappeared. The latter view came to be widely accepted.

Although persons with trachoma were not inducted into the Austrian Army before World War I, during the war they were accepted in special noncombatant trachoma battalions. After the war a part of Hungary with a German-speaking population was given as a Province to Austria. Thirty percent of the population in this territory were afflicted with trachoma. A campaign against trachoma was started and special care was given to school children. In 5 years trachoma was eliminated from this Province.

When I was in Peking in 1923, I saw a few patients with trachoma. The Chinese were using the same criteria in diagnosing trachoma that we had learned in Vienna. Very few of their cases were seen in the early stages, however. When I was again in China with the United

<sup>1</sup>Presented at Walter Reed Army Hospital, Washington, D. C., 20 March 1950.

<sup>2</sup>The New York Eye and Ear Infirmary.

Nations' Relief and Rehabilitation Administration and the World Health Organization in 1946 and 1947, I was surprised to find that great difficulty in diagnosis was being experienced. I was asked to examine the inmates of the Tsai Ho Ching Camp for destitute children. With 10 other trained ophthalmologists we examined more than 1,000 children, and found that many of the children between 6 and 14 years of age had a transparent conjunctiva and numerous yellow, steeply elevated nodules in the upper tarsus. The lower retro-tarsal fold showed little change and there was no hypertrophy of the conjunctiva. These were certainly not the typical findings seen in trachoma. Many of the Chinese oculists, however, diagnosed these cases as trachoma. The opinion and diagnosis of the Chinese physicians varied a great deal (table 1). It was surprising that the military survey shown in the table revealed more trachoma than the survey of refugees. In the Tsai Ho Ching Camp, I found trachoma in 65 percent while the 10 other observers found it in 9.5 to 100 percent. In patients with trachoma in the first stage the diagnosis was doubtful in 14 of my cases, so the true percent of trachoma was probably less than 65. It was also surprising that C. H. Chow found trachoma in only 33.5 percent of the patients in the outpatient department of the Peking University Medical College. The figures of E. Chang and H. H. Chi were likewise unusual since only patients with ocular disease were included in their study and a higher percent with trachoma would be expected. The Rotary Club in Lanchow, like several others in China, sponsors an outpatient department for patients with trachoma. For several weeks I examined all the patients in this department and found that only 82 percent actually had trachoma.

TABLE 1 - Percent of patients diagnosed trachoma in China

Observer	Source of patients	Number examined	Trachoma percent
C. H. Chow	Refugees	22,771	41.1
C. H. Chow	Outpatient department Peking University Medical College	4,150	33.5
Group of ophthalmologists	School children	231,203	14.46
T. Y. Mao	Primary school children (Chengtu 1941-42)	4,910	20
Chinese Army Medical Corps	Chinese Army guards of the 4 Corps	412	76.75
Group of 11 ophthalmologists	Refugee Camp Tsai Ho Ching	3,047	62.10
Eugene Chang	Inpatients West China University (1940-41)	1,025	32.2
H. H. Chi	Inpatients West China University (1940-41)	2,903	45
A. Fuchs	Trachoma section of outpatient department Lanchow	-	82

<sup>1</sup> 20 percent considered doubtful not included in this figure

<sup>2</sup> This is an average. The range was 42 to 62 percent

These discrepancies can only be explained on the basis of the diagnosis of common chronic conjunctivitis as trachoma. Furthermore,

two conditions are seen in China that are similar to trachoma: (a) yellow nodules in the transparent tarsal conjunctiva without special involvement of the upper and lower retrotarsal fold, and (b) severe chronic conjunctivitis caused by constant wind and dust leading to papillary hypertrophy of the conjunctiva. To diagnose these doubtful types of conjunctival change, smears of conjunctival epithelium were stained with Giemsa stain; if inclusion bodies were seen, trachoma was present. Another way to make a diagnosis was to give an adequate course of treatment in doubtful cases: if the conjunctival manifestations disappeared in from 4 to 6 weeks there was no trachoma. In former years, a treatment of at least 2 years was necessary to cure true trachoma. Today, 5 to 6 months usually suffices. At a meeting of the Bureau of Public Health in Nanking, 10 experienced Chinese ophthalmologists maintained that trachoma could usually be healed in 6 weeks. This statement only proves that most of the cases were not true trachoma. That true trachoma takes just as long a time for healing in China as elsewhere was shown by the fact that a Chinese ophthalmologist with trachoma still had active manifestations of the disease after 2 years of energetic treatment.

Although Duke-Elder<sup>2</sup> states that trachoma usually starts imperceptibly and subacutely, and this has been my experience, many ophthalmologists still believe that trachoma starts as a severe acute inflammation. It is true that in the beginning there is often a mixed infection. This is observed especially in Egypt where so many other types of severe infectious conjunctivitis are seen. In these cases, the virus of trachoma is transmitted with the conjunctival secretion. In Egypt the flies that often literally cover the eyes of children apparently transmit the disease.<sup>3</sup> In a country where there is much trachoma special attention must be paid to patients with severe conjunctivitis. Duke-Elder emphasizes the following characteristics of acute trachoma: (a) severe secretion and irritation; (b) a velvety papillary condition of the palpebral conjunctiva; (c) thin gray lines or points and sometimes larger foci in the superficial corneal layer; and (d) swelling and tenderness of the preauricular gland. The last finding is not present in chronic trachoma.

It is difficult to recognize trachoma in the early stage when there are no signs of irritation. I shall not discuss signs that can be seen only with the slit lamp. They are of scientific interest but for the examination of large numbers of patients we cannot rely on them.

<sup>2</sup> DUKE-ELDER, W. S.: *Text Book of Ophthalmology*, Vol. II. C. V. Mosby Co., St. Louis, Mo., 1937 (reprinted 1946), p. 1611.

<sup>3</sup> FUCHS, A.: *Suggestions for prevention of Blindness*. Am. J. Ophth. 17: 232-237, Mar. 1931.

were reported. He had had repeated sore throat and enlarged tonsils for many years and had been advised to have a tonsillectomy.

On admission the temperature was 99° F., the pulse, 92; and the respirations were 20. The face and anterior portion of the neck were flushed. A discrete maculopapular rash was noted on the thorax and extremities; including the palmar and plantar surfaces with lesions measuring 0.5 to 1.5 cm. in diameter. There was conjunctival injection; no petechiae were seen; and the fomili were normal. The nasal passages were moderately congested and the tonsils were moderately hypertrophied and injected, but no membrane or exudate was seen. There was no cervical lymphadenopathy or rigidity. A soft, blowing, Grade I systolic murmur was heard just medial to the apex. The spleen was not palpable. The left hand, the right knee, and left ankle were diffusely swollen without evidence of effusion. The neurologic examination was normal. In the first week after admission the temperature varied between 99° and 102° F. There was a moderate tachycardia and the patient complained of malaise although he appeared to feel better than the objective findings warranted. A purpuric and petechial rash associated with an indurated maculopapular area 3 cm. in diameter was noted about the ankles. Similar lesions were noted at the distal interphalangeal joint of the left third finger and at the base of the right thumb. These lesions were associated with swelling and moderate discomfort. No painful areas were ever found at the tips of the fingers or toes, nor were any typical petechiae seen on repeated examination of the conjunctivae, buccal mucosa, nail beds, or elsewhere.

The erythrocyte count on admission was 4.6 million with 14 gm. of hemoglobin. The leukocyte count was 34,000 with 87 percent neutrophils and 13 percent lymphocytes. Two days after admission the leukocyte count was 23,000; on the fifth day it was 20,000 with 78 percent neutrophils; and on the eighth day it was 7,000. The sedimentation rate was 40 (Wintrobe). Agglutinations for *Salmonella typhimurium*, *Bacillus* and heterophil antibodies were negative. The Weil-Felix reaction with OXK antigen was positive in a titer of 1:100. Repeated blood cultures were taken on thioglycollate medium. Three were positive for *Neisseria intracellularis*. Aspiration of the skin lesions failed to reveal any organisms. Cerebrospinal fluid studies revealed a normal pressure, clear fluid, and 3 leukocytes per cu. mm. An EKG revealed a sinus tachycardia, right axis deviation and a PR interval of 0.16 sec.

Specific therapy and antibiotic drugs were withheld until a definite diagnosis could be established, then starting with an initial dose of 2 grams of sulfadiazine, the patient was given 1 gram of sulfadiazine every 4 hours and 50,000 units of penicillin every 3 hours. The temperature returned to normal by the following morning and remained so. No new skin lesions appeared. The rash slowly faded and disappeared. The leukocyte count and sedimentation rate returned to normal. Several blood cultures were negative and a second Well-Felix reaction was negative. Penicillin and sulfadiazine were discontinued after 12 days of normal temperature, the patient having received 4,800,000 units of penicillin and 62 grams of sulfadiazine.

#### DISCUSSION

Herrick<sup>2,3</sup> believed that meningococcus infection occurred in three stages: (a) primary localization in the nasopharynx of patients, normal persons, and carriers; (b) invasion of the blood stream by the

more virulent organisms, sometimes lasting for weeks, months, or even years; and (c) involvement of the various systems. Hematogenous metastases to the meninges accounts for the more familiar meningococic meningitis. Implantation may occur in the synovia causing artralgia. Involvement of the capillaries and other skin structures produce various types of rash.<sup>12</sup> The concept of hematogenous spread as opposed to the alternative of direct extension along the nerve roots is now commonly accepted.<sup>13</sup> Hematogenous spread can be explained by a phagocytosis of the meningococci in the nasopharynx and then a breakdown of the phagocytes by the virulent meningococic toxin liberating the organisms into the blood stream.<sup>14</sup>

In an epidemic outbreak 60 to 70 percent of the local population become carriers.<sup>9</sup> Although the proportion of carriers in a population, usually 2 to 10 percent between epidemics, may rise to 80 percent during an epidemic.<sup>15</sup> Bernhard and Jordan<sup>16</sup> reported that less than 25 percent of the cultures from the nasopharynges of 3,846 contacts were positive. Despite the fact that the disease, which is not highly contagious, occurs in epidemics, no remarkable incidence of cross infection has been demonstrated. Some as yet unknown factor probably causes the change from a carrier state to a diseased state. Broders and Snell<sup>17</sup> reported that as high as 35 percent of patients do not show meningeal involvement at the time of the initial diagnosis.

A typical patient with meningococcemia presents the findings of an acute febrile disease of abrupt onset associated with widespread skin lesions of various types with accompanying vague joint and muscle pains and often gives a history of antecedent upper respiratory infection. The fever is usually remittent, but not high. It may be quotidian, tertian, or even quartan and of short or long duration. The most significant clinical findings are the skin lesions that may be maculopapular, petechial, hemorrhagic, purpuric, or even necrotic in localized areas. They may resemble the lesions of erythema nodosum. The minimal petechial lesions centered in maculopapules have been likened to insect bites. A careful and repeated search should be made for the skin lesions as they may be few and evanescent. New

<sup>12</sup> HEINLE, R. W. Meningococcal septicemia: report of 5 new cases. *Arch. Int. Med.* 63: 573-583, Mar. 1959.

<sup>13</sup> STEONG, P. S. Recognition of meningococcal infections. *Am. J. M. Sc.* 206: 561-566, Nov. 1943.

<sup>14</sup> CAMPBELL, E. P. Meningococcemia. *Am. J. M. Sc.* 216: 566-576, Nov. 1943.

<sup>15</sup> BERNHARD, W. G., and JORDAN, A. C. Purpuric lesions in meningococcal infections: distinction from smears and cultures of purpuric lesions. *J. Lab. & Clin. Med.* 29: 277-281, Mar. 1944.

<sup>16</sup> BRODERS, A. C., JR., and SNELL, A. M. Fulminating meningococcemia with gangrene. *Am. J. Med.* 3: 657-660, Nov. 1947.



# Mesenteric Cyst

## Report of a Case

ROBERT B. STROTHER, Commander (MC) U. S. N.<sup>1</sup>

CYST of the mesentery is a rare pathologic condition of surgical importance. It has a reported incidence of 1 per 100,000 hospital admissions (1). The great difficulty in making a preoperative diagnosis and the problems presented in the surgical treatment make it a subject of great interest.

There is a great difference of opinion in regard to the classification of mesenteric cysts, probably because their origin is obscure: many types have been described. According to Warfield (2) they originate from retroperitoneal organs, namely the germinal epithelium, ovary, wolffian or müllerian bodies. Remnants of these tissues are thought to be displaced between the leaves of the mesentery where they take up an independent and aberrant existence. A logical theory is that of displaced embryonal intestinal tissue. Other theories involve dermal inclusions, as suggested by Bartlett in 1923; angiomas; pseudocysts of bacterial, infectious, or of malignant sources; and lymphatic obstruction.

Many cysts remain so small as to be symptomless. However, symptoms may occur as the result of mass, traction, compression, or torsion with the resulting compromise of the intestinal lumen or of the blood supply. Chronic or acute intestinal obstruction was present in over 50 percent of the recorded cases (3).

Pathologically the two most commonly encountered mesenteric cysts are the enteric and those consisting of dilated lymphatic channels; the size varies greatly. Enteric cysts are usually unilocular and contain mucoid material. Histologically the wall of the cysts may duplicate that of the intestine. However, as the cyst becomes larger there may be a fibrous replacement of the mucosa and later of the muscle layer.

A correct preoperative diagnosis of the uncomplicated case is difficult and in the presence of the most common complication, intestinal obstruction, an accurate diagnosis is nearly impossible.

<sup>1</sup>U. S. Naval Hospital Great Lakes, Ill.

the appendix found to be perforated just proximal to the tip. The bladder was edematous and pericestitis was present. The appendix was removed and 1 gram of streptomycin and 1,000,000 units of penicillin were placed in the peritoneal cavity. The incision was closed without drainage.

Postoperatively, intravenous fluids and Wangensteen suction were continued for 4 days. Convalescence was complete in 7 days and was uneventful except for the occurrence of a superficial wound infection. Streptomycin, 0.25 gram every 6 hours for 5 days, was given intramuscularly. Penicillin, 100,000 units every 6 hours for 10 days, was also administered.

## DISCUSSION

The urologic manifestations of acute appendicitis include (*a*) disorders of micturition, (*b*) tenderness in the right costovertebral angle, (*c*) pain and retraction of the testes, and (*d*) abnormalities of the urine.

*Disorders of micturition.*—Urinary frequency and dysuria are the most frequent urinary complaints (1). These can be attributed to direct irritation of the renal pelvis, ureter, or bladder by the inflamed appendix. Because the appendix has at least six normal positions in the abdomen, namely, retrorectal, splenic, promontorial, pelvic, inguinal, and para-aortic reaching the right kidney, any portion of the genito-urinary tract can be affected (2). The most frequently involved site of irritation appears to be the right ureter at the brim of the bony pelvis. Urinary retention is caused by an irritation of the bladder sphincter, but this is an uncommon symptom (3).

*Tenderness in the costovertebral angle.*—Cope (4) found this to be a common symptom in appendicitis and maintained that it did not always signify a retrocecal appendix, since the pain could be elicited in patients in whom operation revealed the appendix not lying on the quadratus lumborum muscle. He believed such pain to be caused by hyperesthesia of the posterior area supplied by the tenth thoracic nerve, the segment that also supplies the appendix. When a perforated appendix lies on the quadratus lumborum muscle, this symptom is pronounced and simulates a perinephritic abscess.

*Pain and retraction of the testes.*—Testicular pain and discomfort occur in about 5 percent of male patients with appendicitis (4). The pain is usually not as severe as the abdominal pain, and is described as dull, aching, or sharp. This is probably a referred pain, since the appendix and testes are innervated by the same cord segment. The retraction of the right testis may be caused by direct irritation of the genitofemoral nerve producing a contraction of the cremaster muscle.

*Abnormalities of the urine.*—A few red blood cells are frequently seen in routine urine specimens of patients with appendicitis. In most cases this is caused by a true periureteritis (5) (6) (7). Frank hematuria that disappears after appendectomy in otherwise typical

cases of appendicitis has also been described. Ehlert (1) explained the pyuria similarly. The inflamed appendix in contact with the right ureteral wall produces a perireteritis and ureteritis that results in pus cells being cast into the ureteral lumen, eventually appearing in the urine. Harbin (6) believed the pyuria to be caused by a concomitant pyelitis. The appendicitis and pyelitis are thought to be metastatic infections arising from some common focus. Another factor, especially in chronic pyelitis caused by chronic appendicitis, may be a lymphogenous ascent of colon bacilli up the periureteral lymphatic vessels to the kidney. Van Duzen (7) listed appendicitis as the probable cause in 7.6 percent of 300 cases of pyelitis. Massive pyuria can occur when an appendiceal abscess ruptures into the bladder. Albuminuria is usually attributed to the pus and red blood cells in the urine.

The patient described in the case report presented an array of urinary symptoms and signs suggestive of a genito-urinary disorder. Although cystoscopy and pyelograms frequently aid in making the correct diagnosis, visual signs of cystitis, ureteritis, or pyelitis would not account for the presence of peritonitis. The wisdom of early laparotomy in this type of case is well substantiated by the unfortunate result in the case reported by Ehlert (1). Acute appendicitis which can usually be easily recognized and diagnosed in its typical textbook form may also present a problem calling for the greatest diagnostic acumen.

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2. TREVES, F.: *Surgical Applied Anatomy*. 9th edition, revised by C. G. Choyce. Lea & Febiger, Philadelphia, Pa., 1934.
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special emphasis on basic research. During periods of armed conflict, the exigencies of war require immediate application of new methods, weapons, and practical means of defense against them. Advances in military medicine must then be confined to applied research and development. But as time marches on, our stockpile of science and of scientific talent must be increased between wars by basic research, which can be pursued to best advantage during periods of peace when graduate students can be thoroughly trained at universities, teaching hospitals, and at naval research facilities as capable scientific investigators.

Research as such may be defined as critical investigation or experimentation to establish or discover new facts. Without research, modern medicine never would have become "modern." If medical research, both basic and applied, were prohibited by lack of funds, facilities, personnel, or vision (or all four), military medicine would promptly wither away.

The importance of basic research to the military surgeon must be apparent when we consider the "who, what, when, where, why" of atomic energy. Knowledge of nuclear fission grew to its present formidable estate by virtue of two factors; basic science and teamwork between basic scientists and administrators in devising methods for practical application of fundamental knowledge. The sum total of science is derived from the contributions of many minds, research laboratories, and countries where freedom of thought, freedom in scientific research, and freedom of expression are (or were) considered sacrosanct. This outstanding example of the dependence and interdependence of practical or applied science upon fundamental research and basic investigation in pure science is familiar to all of us. Surely, the Manhattan Project needs no scientific justification.

In the fields of medicine, both military and civilian, the discovery and development of penicillin demonstrate the correlation between basic and applied research and emphasize once again the crucial importance of fundamental investigations in the basic sciences as applied to the healing art. Penicillin was discovered by Sir Alexander Fleming in 1928, but its lifesaving potentialities were not recognized until 1939, when it was determined by other medical scientists that this new drug possessed antibiotic activity. Military necessity then demanded the rapid development of this "product" of basic research in microbiology, so that the manufacture and distribution of a complex chemical compound, considered a mere laboratory curiosity until the Battle of Britain began, had grown to a gigantic industrial endeavor by 1945, when the Rising Sun of Japan foundered beneath the western horizon.

### PHILOSOPHY

Fundamental principles derived from laboratory research in the basic medical sciences must be applied in the clinical treatment of the ill or injured patient. Technical data from numerous and diversified engineering laboratories implement procedures in preventive medicine for the control and eradication of tropical and infectious diseases. Hence, the modern military surgeon can fulfill his mission because today's research in medicine and the sister sciences becomes tomorrow's practice, both in peace and in war.

Of arms and the man, man is indispensable. No industrial machine or engine of war has yet been devised better than the personnel who operate it. Thus, man-power is and will continue to be our greatest and our most precious asset. The preservation of man's health, efficiency, and morale has been and will continue to be proportional to the advances in scientific medical research available to the military surgeon in his unceasing effort "to bring light to them that walk in darkness and in the shadow of death, and to guide our feet in the paths of Peace."



umpire coverage of the Army medical units participating. Each battalion aid station (figs. 1 and 2) and regimental collecting station was assigned a separate medical umpire, as was each separate medical unit and each company within the divisional medical battalion. In addition, one Navy medical officer was assigned as Navy medical liaison officer with the Army Umpire Group.

#### UMPIRE TRAINING

An umpire school was conducted for all ground umpires at Headquarters, Army Umpire Group, Camp Lee, Va., to prepare the umpires to carry out their assignments with optimal proficiency. The initial phases of the instruction covered basic orientation concerning organization and employment of the arms and services organic to an infantry division, indoctrination concerning the Aggressor concept, and a re-



Figure 2.—Interior of aggressor aid station established in Operation Portrex

view of the umpire manual and general umpiring principles. A great deal of instruction was given in signal communications and familiarization with the signal equipment to be used by umpires in the proposed operation. Later, the umpires were given ship-to-shore amphibious training at Little Creek, Va., followed by a trip to Langley Field, Va., where various aircraft and their capabilities were demonstrated. The terminal portion of the umpire training was devoted to a command post exercise, and separate conferences on specific medical check lists to be used in the actual operation. All umpires were then transported

to Vieques Island where a base camp for the Army Umpire Group had been established. While there, an on-the-ground terrain study was made of the maneuver ground, including a detailed study of possible landing beaches. A series of field problems were conducted on the actual maneuver terrain, initially, without troops and later with participating troops of the Aggressor Force, prior to the actual maneuver.

The umpires designated to umpire units of the Joint Task Force were then transported by air back to Norfolk where they joined their respective units. This arrangement allowed for on-the-ground reconnaissance of the maneuver area prior to the operation, better familiarization with the personnel, equipment, and plans of the Aggressor Force, and yet enabled the umpires to observe the actions of the Joint Task Force troops from embarkation to actual beach landings and the maneuver proper.

#### UMPIRE OPERATIONAL PLANS

The general maneuver plan was based on the following assumption: The United States and an enemy nation known as Aggressor were at war. The island of Vieques represented an area of a large theoretical continent and was held by Aggressor troops in garrison after being heavily fortified with well-prepared defensive positions. The Aggressor Forces were in possession of short-range tactical aircraft and submarine forces. The Vieques area was designated by the United States for seizure through amphibious and airborne means, in order to develop a base for a future strategic air operation. It was further indicated that the amphibious operation would be launched from the continental United States and the airborne operation from friendly territory in the Virgins area. The entire operation was to include major land, sea, and air operations.

In the operation, assessment of casualties was carried out by the unit umpires. Medical umpires only assessed casualties occurring in personnel within the specific medical unit being umpired. Casualties were assessed appropriate to the action, with every effort made to promote and further realism. Casualties so assessed were tagged with one of three types of tags: (a) a red tag for seriously wounded casualties, (b) a green tag for slightly wounded walking casualties, and (c) a white tag for those dead as a result of the specific action. A definite appropriate diagnosis appeared on the tag, calculated to necessitate certain specific first-aid and medical treatment procedures on the part of those medical personnel manning the various medical installations. Also, specific instructions to the assumed casualty were on the tag, governing what physical actions, if any, he might take.

certain organizations; and (c) the number of board-certified and board-qualified officers that would be available to each using command in the succeeding fiscal year. It was believed that by carefully evaluating each of these elements, the requirement of and the authorization to each command would be equitably resolved.

This action has been completed and each using command has been advised of its authorization. In general, the civilian consultant program for the fiscal year 1951 has been designed to effect a reduction of about \$250,000 below the amount expended in the fiscal year 1950. Concurrent with the aforementioned study, efforts were made to determine a method by which all using commands could be made responsible for the appointment and reimbursement of their respective consultants. These efforts are in keeping with the decentralization directive of the Chief of Staff. It has been determined that such a decentralization will be effected on or about 1 January 1951 so as to give this authority to continental Army commanders, the Commandant, United States Military Academy, and the commanders of Tripler and Rodriguez Army Hospitals. At present such authority is exercised only by the commanding officers of the named Army hospitals in the continental United States. Specific instructions will be issued when appropriate.

As a result of this evaluation it may be concluded that the Medical Service will continue to implement its civilian professional consultant program in the most economical manner that will assure the desired results.



## BOOKS RECEIVED

**SIMPLIFIED CHEMISTRY EXPERIMENTS.** by Armand Joseph Concheire, Instructor in Biological Chemistry, Hahnemann Medical College, Philadelphia, Pa.; Science Instructor, Hahnemann Hospital School of Nursing, Philadelphia, Pa., formerly Laboratory Supervisor, Human Serum Albumin Department, Sharp & Dohme, Incorporated, Glenolden, Pa.; formerly Analytical Chemist, The Barrett Division, Allied Chemical & Dye Corporation, Philadelphia, Pa. Edited by M. Cordella Cowan, Illustrated by Richard Albany. 234 pages. Illustrated. G. P. Putnam's Sons, New York, N. Y., publishers, 1950. Price \$2.50.

**A TEXTBOOK OF ORTHODONTIA.** by Robert H. W. Strang, M. D., D. D. S., Director of courses in orthodontia in the extension teaching departments of Columbia University and the University of Toronto; Director of the Fones School of Dental Hygiene, University of Bridgeport. Co-editor of "The Angle Orthodontist", Consulting Oral Surgeon to the Bridgeport Hospital, Bridgeport, Conn. 3d edition. 825 pages. Illustrated. Lea & Febiger, Philadelphia, Pa., publishers, 1950. Price \$15.

**A TEXTBOOK OF PSYCHIATRY** for Students and Practitioners, by Sir David Henderson, M. D. (Edin.), F. R. F. P. S. (Glas.), F. R. C. P. (Ed. and Lon.). Physician Superintendent of the Royal Edinburgh Hospital for Mental Disorders, and Professor of Psychiatry, University of Edinburgh, and the late R. D. Gillepsie. 7th edition. 740 pages. Oxford University Press, New York, N. Y., publishers, 1950. Price \$7.75.

**ANNUAL REPRINT OF THE REPORTS OF THE COUNCIL ON PHARMACY AND CHEMISTRY OF THE AMERICAN MEDICAL ASSOCIATION,** with the comments that have appeared in the Journal of the American Medical Association, 1949. 231 pages. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1950. Price \$2.

**TYPES OF DIABETES MELLITIS AND THEIR TREATMENT.** by Arthur R. Colwell, M. D., Associate Professor of Medicine and Director of Medical Specialty Training, Northwestern University Medical School; Attending Physician, Evanston Hospital, Consulting Physician, Wesley Memorial Hospital, Municipal Tuberculosis Sanitarium, Chicago, Ill. Publication Number 67, American Lecture Series. 97 pages. Charles C Thomas, Publisher, Springfield, Ill., 1950. Price \$1.25.

**THE PHYSIOLOGICAL BASIS FOR OXYLEX THERAPY.** by Julius H. Comroe, Jr., Professor of Physiology and Pharmacology, Graduate School of Medicine, University of Pennsylvania; Clinical Physiologist, Hospital of the University of Pennsylvania; and Robert D. Driggs, Professor of Anesthesiology, University of Pennsylvania School of Medicine. Director of Anesthesiology, Hospital of the University of Pennsylvania. Publication Number 42, American Lecture Series. 85 pages. Charles C Thomas, Publisher, Springfield, Ill., 1950. Price \$2.

**MALARIA DISEASE AND ITS TREATMENT** by RAMA M. by Sir Stamford Dale, K. B. E., F. R. C. S., M. R. C. P., Surgeon, Westminster Hospital; Consulting Surgeon, Mount Vernon Hospital and Barium Institute; Lecturer in Surgery, Westminster Medical School and formerly Examiner in Surgery, University of London; Member of the Council and of the Court of Examiners, late Hunterian Professor and Arts and State Lecturer, Royal College of Surgeons of England; Hon. Member American Malaria Society; Consultant in Surgery to the Naval Air Fleet, with a foreword by Sir Ernest Gruen Carling, F. R. C. P., F. R. C. S., F. R. S., Consulting Surgeon and Vice-President, Westminster Hospital. Volume III. 2d edition. 446 pages. Illustrated. The Williams & Wilkins Co., Baltimore, Md., publishers, 1950. Price \$12.50.

**PEN'S SURGICAL HANDBOOK.** A Manual of Surgical Manipulations, Minor Surgery, and Other Matters Connected With the Work of Surgical Dressers, House Surgeons and Practitioners, edited by Hamilton Bailey, F. R. C. S. Eng., Surgeon, and Surgeon-in-charge of the Geological Department, Royal Northern Hospital, London;

is most welcome. The authoritative role given the therapist throughout the part of the book dealing with treatment of specific reaction patterns although useful in some situations, may in itself place undesirable limits on therapy with many patients. This is especially true with children. It was disappointing to find the primary therapeutic recommendation in emotionally disturbed children was "placement in a foster family or boarding school." —Commander M. E. Rondebusch (MC) U. S. N.

**PENICILLIN AND STREPTOMYCIN IN THE TREATMENT OF INFECTIONS** by Chester S.

Keefer, M. S. M. D. Sc. D. (Hon.), Wade Professor of Medicine, Boston University School of Medicine; Director of Evans Memorial and Physician-in-Chief, Massachusetts Memorial Hospital, Boston, Chairman, Committee on Chemotherapeutic and Other Agents, National Research Council, Consultant to the Committee on Medical Research, Office of Scientific Research and Development Washington, D. C., and Donald G. Anderson, M. D. Instructor in Medicine, Boston University School of Medicine; Research Fellow in Medicine at Evans Memorial; Assistant Visiting Physician, Massachusetts Memorial Hospital, Boston, Mass., edited by Henry A. Christian A. M. M. D., LL. D. Sc. D. (Hon.), M. A. C. P., Hon. F. R. C. P. (Can.), D. S. M. (A. M. A. 1. Hersey Professor of the Theory and Practice of Physic Emeritus Harvard University; sometime Clinical Professor of Medicine Tufts Medical School; sometime Physician-in-Chief, Curney Hospital, sometime Visiting Physician, Beth Israel Hospital, Physician-in-Chief Emeritus, Peter Bent Brigham Hospital, Boston Mass. (Reprinted from Oxford Loose-Leaf Medicine with the same page numbers as in that work) 111 pages Oxford University Press, New York N. Y., publishers, 1950 Price \$2.50

Here, two sections from the Oxford Loose-leaf Medicine are separately bound and offered as a book. The same plates were used so the pages bear their original numbers from the larger work. The section on penicillin consists of 47 pages of text and 18 pages of bibliography which is classified under various subtitles. The section on streptomycin contains 30 pages of text and 12 pages of bibliography similarly classified. The emphasis is on treatment. The text has been condensed until there seems to be hardly a single superfluous word. For the busy general practitioner who desires the latest authoritative word on these drugs, this is the book. It has an index.—Commander H. J. Alcis (MC) U. S. N.

**A PRIMER OF VENOUS PRESSURE**, by George E. Burch, M. D., Henderson Professor of Medicine, Tulane University School of Medicine, Senior Visiting Physician, Charity Hospital, Consultants in Cardiovascular Diseases, Ochsner Clinic; Visiting Physician, Touro Infirmary, New Orleans. 174 pages illustrated. Lea & Febiger, Philadelphia, Pa., publisher, 1950. Price \$4.

Few subjects in medicine have received more attention in recent years than the cardiovascular system. Early in this study particular interest was directed toward the heart, and recently the peripheral circulation has been the source of much investigation. The venous system has lagged behind and this book calls attention to the importance of experimental and clinical investigation in this area. The book is primarily concerned with fundamentals but includes a practical discussion of bedside techniques of venous pressure measurement. The author makes no claim to an exhaustive treatise on the subject of venous pressure but has brought a neglected subject to the attention of medical students and clinicians. Officers in the field will find the discussion of arteriovenous aneurysm of

Interest. There is no bibliography. The illustrations, binding, and index are excellent.—*Lt. (jg) D. B. Carmichael, Jr. (MC) U. S. N.*

**A SHORT HISTORY OF PHYSIOLOGY**, by Kenneth J. Franklin, D. M., F. R. C. P., Professor of Physiology at the Medical College of St. Bartholomew's Hospital, 2d edition. 147 pages; Illustrated Staples Press, New York, N. Y., publishers, 1950. Price \$2.

This concise volume condenses the history of physiologic endeavor up to the beginning of the twentieth century. Covering such a wide period, it hardly does more than catalogue names and events. This is done by centuries and by organ systems, however, and with the coherence and readability that characterize so many British authors. Da Vinci, Fernel, and Vesalius are treated, deservedly, in separate chapters, and Harvey is dealt with in great detail. Professor Franklin believes: " \* \* \* it would be inviolable for me, as a practicing physiologist, publicly to assess the work of others still alive." Still, it is unfortunate that the events of this century are omitted entirely. For the serious student this book would make an excellent reference text leading to further detailed reading, and at the same time would serve as a valuable orientative work for the more casual historian of physiology and medicine.—*Lt. R. K. Nixon (MC) U. S. N.*

**THE PRACTICE OF MEDICINE**, by Jonathan Campbell Meakins, C. B. E., M. D., LL. D., D. Sc., formerly Professor of Medicine and Director of the Department of Medicine, McGill University; formerly Physician-in-Chief, Royal Victoria Hospital, Montreal; formerly Professor of Therapeutics and Clinical Medicine, University of Edinburgh; Fellow of the Royal Society of Edinburgh; Fellow of the Royal Society of Canada; Fellow of the Royal College of Physicians, London; Fellow of the Royal College of Physicians, Edinburgh; Honorary Fellow of the Royal College of Surgeons, Edinburgh; Fellow of the Royal College of Physicians, Canada; Fellow of the American College of Physicians; Honorary Fellow of the Royal Society of Medicine. 5th edition. 1,558 pages; Illustrated. The C. V. Mosby Co., St. Louis, Mo., publishers, 1950. Price \$13.50.

This attractive fundamental textbook of medicine has undergone four revisions since 1936. It begins with an introductory chapter to the practice of medicine, usually missing or meager in similar modern texts, and then successively considers each system, except the skin and organs of special sense. All of the subjects are presented by Dr. Meakins except for the sections concerned with diseases of metabolism, the endocrine, urinary, and nervous systems, and the chapter on psychosomatic medicine. Few internists today would undertake such an enormous task of single authorship and the success of this volume is a tribute to the wealth of experience, breadth of vision, and proficiency of literary expression of the author. The 518 photographs and diagrams, of which 50 are in color, are an outstanding feature. Since the fourth edition, published in 1941, about 100 pages and 2 color plates have been added. Two new and excellent chapters, one on psychosomatic medicine by Dr. Hanson and the other on chemotherapy and antibiotics, are the major additions. The former constitutes a distinct advance as there is nothing to compare with it in any other current general book on medicine. Dr. Mason has revised the excellent chapter on diseases of metabolism and has collaborated with Dr. Hoffmann in rewriting the section on diseases of the ductless glands. Dr. Schriner's division on diseases of the urinary system has also been brought up to date and includes a discussion of lower nephron nephrosis. The large section on neurology by Dr. Petersen

at hand, and yet the possibility of brucellosis must constantly be in the minds of those who practice in remote areas. The symptoms are treated both in general and by regions. This latter approach makes it clear why this book is important to many specialists. The problems of diagnosis are described individually and then considered in their interrelationship. Laboratory methods are described sufficiently to make them understandable and references are available for the technical details. There is an excellent condensed section on differential diagnosis. The chapter on treatment takes up one by one the various proposals that have been made in recent years and points out their successes and shortcomings. This section is up to the minute in that recent additions to the antibiotics are considered. The various biologic preparations are given appropriate recognition. Unique and particularly interesting is the chapter on psychologic studies appearing first in this edition. Here the psychosomatic aspect of the disease is presented in a way that holds one's attention. Thoroughly adequate chapters on the epidemiology and prophylaxis of brucellosis are included.

One often reads of this or that book as being indispensable in the physician's library. If such a collection exists this book will surely find its place there. Specialists or general practitioners, in urban or rural areas, will profit by reading this book. It may well become one of the American medical classics.—Commander H. J. Alvis (MC) U. S. N.

**AMPUTATION PROSTHETIC SERVICE.** by Earle H. Daniel, Director of Prosthetic Service, Institute of Physical Medicine and Rehabilitation, New York University, Bellevue Medical Center. Prosthetic Consultant to Bellevue, City, Goldwater Memorial, Metropolitan, and University Hospitals, New York, N. Y., with foreword by Howard A. Rusch, M. D., Professor and Chairman of the Department of Physical Medicine and Rehabilitation, New York University College of Medicine, Director, Institute of Physical Medicine and Rehabilitation, New York University, Bellevue Medical Center. 327 pages, illustrated. The Williams & Wilkins Co., Baltimore, Md., publishers, 1950. Price \$7.

This text should be of great value and interest to anyone associated with amputees, as it presents much valuable information as to types and construction of prostheses. It is written from the prosthetic makers point of view, yet by one who is well versed in the necessity of coordinating the efforts of the many skilled and professional persons who work with the amputee. The author presents answers to many problems that confront the surgeon in prescribing the proper prosthesis for his amputee patient and in training him in its use. He also presents in detail the many factors in proper fitting and construction of artificial limbs and includes a valuable Buyer's Guide for purchase of materials, a List of Certified Limb and Brace Makers, a Selected List of Motion Pictures on Rehabilitation and Physical Medicine, and a Glossary of Prosthetic Terms. The numerous illustrations aid greatly in the presentation of the subject which often is primarily technical in relation to the construction of prostheses. A wealth of practical information as to the proper fitting of artificial limbs, the correct type of limb, preparation of the stump, and training use of the limb is included. I believe that every surgeon who performs amputations as well as those who take part in the rehabilitation of amputees, such as the specialist in physical medicine and rehabilitation, the physical therapist, and the prosthetic makers should be acquainted with this book.—Commander J. S. Thiemeyer, Jr. (MC) U. S. N.

**NEW DISCOVERIES IN MEDICINE, Their Effect on the Public Health**, by Paul R. Hawley, 134 pages; illustrated. Columbia University Press, New York, N.Y., publishers, 1950. Price \$2.50.

The material presented in this volume is a compilation of a series of Banting lectures delivered by the author. They were designed for presentation to a lay audience and much of the content is not challenging to the physician. Four topics were considered: blood, operations on the heart and lungs, prevention and treatment of mental disease, and the socioeconomic aspects of medical care.

Except for minor considerations the picture presented to the nonprofessional person is clear and valid. The discussion of the relationship of the Rh factor to pregnancy seems unnecessarily threatening, and the complexities of cardiac operations force the author into extremely superficial treatment of this subject. In the area of medical economics, however, both the layman and the physician will find a stimulating discussion. It is in this field that Dr. Hawley has spent many years and here he has made an outstanding contribution. Although many will find his viewpoint unilateral, few will find a better statement of the problems which confront those who would alter the present free-enterprise system. As the pros and cons of "socialized medicine" continue to be weighed, it seems mandatory that physicians, as protagonists in the controversy, should be fortified with all possible facts and mature opinions. The author of this book has contributed both, and his conclusions merit attention.—Lt. (jg) D. B. Carmichael, Jr. (MC) U. S. N.

**A TEXTBOOK OF ORAL HYGIENE AND PREVENTIVE DENTISTRY**, by Russell W. Bunting, D.D.Sc., Professor of Dentistry and Dean of the School of Dentistry, University of Michigan, and collaborators. 240 pages; illustrated. Lea & Febiger, Philadelphia, Pa., publishers, 1950. Price \$5.

Professor Bunting opens the text with a definition of oral hygiene and closes it with a discussion of the present status of the modern dental hygienist. In the chapters between, he and a group of well-known collaborators have concisely presented the subject of preventive dentistry, including descriptions of the more commonly seen pathologic disturbances, their cause, and methods for their control. The 240 black-and-white illustrations and a color plate add to the value of this book which should fulfill the need for a one-text reference on basic science principles for the dental hygienist.

Kerr provides a chapter on the histology of oral structures which includes a chronology of human dentition.

In another chapter he discusses the role of traumatic occlusion in oral disease and describes a technique for the equilibration of occlusion. Bunting discusses the physiologic function of the mouth and its part in the human economy. He also devotes a chapter to accretions on teeth, including extrinsic and intrinsic stains. Jay offers a chapter on the history of caries research. Robinson discusses periodontal disease and includes an admirable one-page classification of cause, pathologic changes, and symptoms. Burkett provides a chapter on stomatitis. Hard's chapter on oral prophylaxis includes a description of a technique for the operator, a patient's toothbrushing technique, and a discussion of dentifrices. Kahn discusses the modern concept of the role of dental foci in systemic disease, and Wilson reviews the status of dentistry in public health.

The format, binding, and paper are excellent and the illustrations are well reproduced.—Maj. J. E. Chipp, DC, U. S. A.

the problem is both basic and clinical, dealing in the first three chapters with every aspect of the nature and function of the clotting process and the relationship of clotting to hemostasis, the latter seven chapters are concerned with the clinical aspect of thrombo-embolic diseases and their therapy, with special emphasis on dicumarol. This book has been written for the clinicians and pathologists who are faced with the problems of anticoagulant therapy daily, and who do not have the time to cope with the voluminous and often contradictory literature on the subject. An appendix consisting of the most accurate and practical laboratory methods in the study of hemorrhagic diseases and anticoagulant therapy is presented. One of these is the photo-colorimetric determination of dicumarol plasma concentration which may in the future obviate the necessity of daily prothrombin times in the use of dicumarol. Every clinician and clinical pathologist concerned with anticoagulant therapy should be familiar with this book.—*Lt (jg) P. K. Hamilton (MC) U. S. N.*





**COVER PHOTOGRAPH**

*With United Nations Forces in Korea.—A South Korean nurse dresses the arm of an American soldier.*

VOL. I

NOVEMBER 1950

NO. 11

# UNITED STATES ARMED FORCES MEDICAL JOURNAL

*Published Monthly by the Armed Forces Medical Publication Agency, Department of Defense*



F. W. FARRAR, Captain, MC, U. S. N., Editor  
WAYNE G. BRANDSTADT, Colonel, MC, U. S. A., Associate Editor  
ROBERT J. BENFORD, Colonel, U. S. A. F. (MC), Associate Editor

THE PRINTING OF THIS PUBLICATION HAS BEEN APPROVED BY  
THE DIRECTOR OF THE BUREAU OF THE BUDGET, OCT. 19, 1949

UNITED STATES  
GOVERNMENT PRINTING OFFICE  
WASHINGTON 1950

For sale by the Superintendent of Documents U. S. Government Printing Office  
Washington 25, D. C. - Price 35 cents

## Foreword

The UNITED STATES ARMED FORCES MEDICAL JOURNAL represents the unification of the BULLETIN OF THE UNITED STATES ARMY MEDICAL DEPARTMENT, published since 1922, and the UNITED STATES NAVAL MEDICAL BULLETIN, published since 1907. This joint periodical is the medium for disseminating information of administrative and professional interest to all medical personnel of the Department of Defense.

It is the aim to include in each issue administrative directives, original scientific and professional articles, editorial comments on current professional literature of special interest, clinical notes, descriptions of new devices and instruments, abstracts of articles from various medical periodicals, and notices and reviews of newly published professional books of interest to all commissioned medical personnel of the Department of Defense.

The Director, Medical Services, and the Surgeons General of the several services extend an invitation to all medical officers, dental officers, Medical Service Corps officers, Nurse Corps officers, officers of the Veterinary Corps, all officers of the ancillary services of the medical services of the Armed Forces, and to the medical consultants of the Army, Navy, and Air Force to submit manuscripts for publication in this JOURNAL.

RICHARD L. MEILING, M.D.

*Director, Medical Services,*

*Department of Defense*

RAYMOND W. BLISS,

*Major General, U.S.A.,*

*Surgeon General, U.S. Army*

CLIFFORD A. SWANSON,

*Rear Admiral (MC) U.S.N.,*

*Surgeon General, U.S. Navy*

HARRY G. ARMSTRONG,

*Major General, U.S.A.F.,*

*Surgeon General, U.S. Air Force*

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F. W. FARRAR, *Editor in Chief,*

*Captain, Medical Corps,*

*United States Navy.*

WAYNE G. BRANDSTADT, *Associate Editor,*

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Subscriptions should be sent to the Superintendent of Documents, United States Government Printing Office, Washington 25, D. C.

Yearly subscription, \$4 foreign subscription, \$5.35

Single number, 25 cents

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warning or foreplanning, a small segment of the United States Air Force (USAF) transported almost 2 million tons of material into Berlin. This article covers only the Airlift as conducted by the USAFE\* (4 Air Force Wings, 2 Naval Transport Squadrons, and USAFE supporting troops). The contribution of the U. S. Army in Europe, the Third U. S. Air Division in England, of the Air Materiel Command in the Zone of the Interior, and of the British and French Forces are beyond the scope of this study.

#### ORIGINAL SITUATION

A review of the situation when the Airlift began is essential for full understanding of the difficulties encountered. The following factors were severe handicaps in the engagement and performance of this mission.

*Indefiniteness.*—The mission of flying over 5,000 tons of material daily to a given destination could probably be accomplished with no extraordinary difficulty if there was a clear delineation of the beginning and ending of such a project and if there could be prior planning. The Berlin Airlift began with scant warning and there was no possible way to estimate the length of the mission.

*Personnel available.*—In June 1948, there were about 15,000 USAF personnel assigned to USAFE. Of these, less than 2,000 were aircrew members. The majority, if not all, of such aircrew members were, at the beginning of the mission, engaged in other duties essential to the mission of USAFE, and as such, could not be spared en masse to take over the Airlift.

*Available airfields.*—In June 1948, USAFE had only two operational air fields within reasonable flying distance of Berlin. These two air bases, Wiesbaden and Rhem Main (fig. 1), had shortages of storage space, maintenance space, and above all, troop housing, that did not allow the performance of the minimal demands of the mission.

*Housing facilities.*—In June 1948, Wiesbaden and Rhem Main housed about 1,000 and 3,000 military personnel, respectively. Full use of these air bases demanded doubling of the population of both but even this could not meet the minimal needs of the Airlift.

*Number of available aircraft.*—In June 1948, the only transport type aircraft available to USAFE were 107 C-47's, all of which were worn war products and presented serious maintenance difficulties. The number of operational C-47 aircraft could not have carried the minimal tonnage to Berlin, although they had been operated constantly.

\* United States Air Force in Europe

*Extent of aircraft maintenance facilities.*—In June 1948, USAFE maintenance facilities consisted of the number of personnel necessary to meet the maintenance needs of the assigned C-47's. Intensification of use of C-47's would severely tax the available facilities. Using them 24 hours a day was beyond the maintenance capabilities.

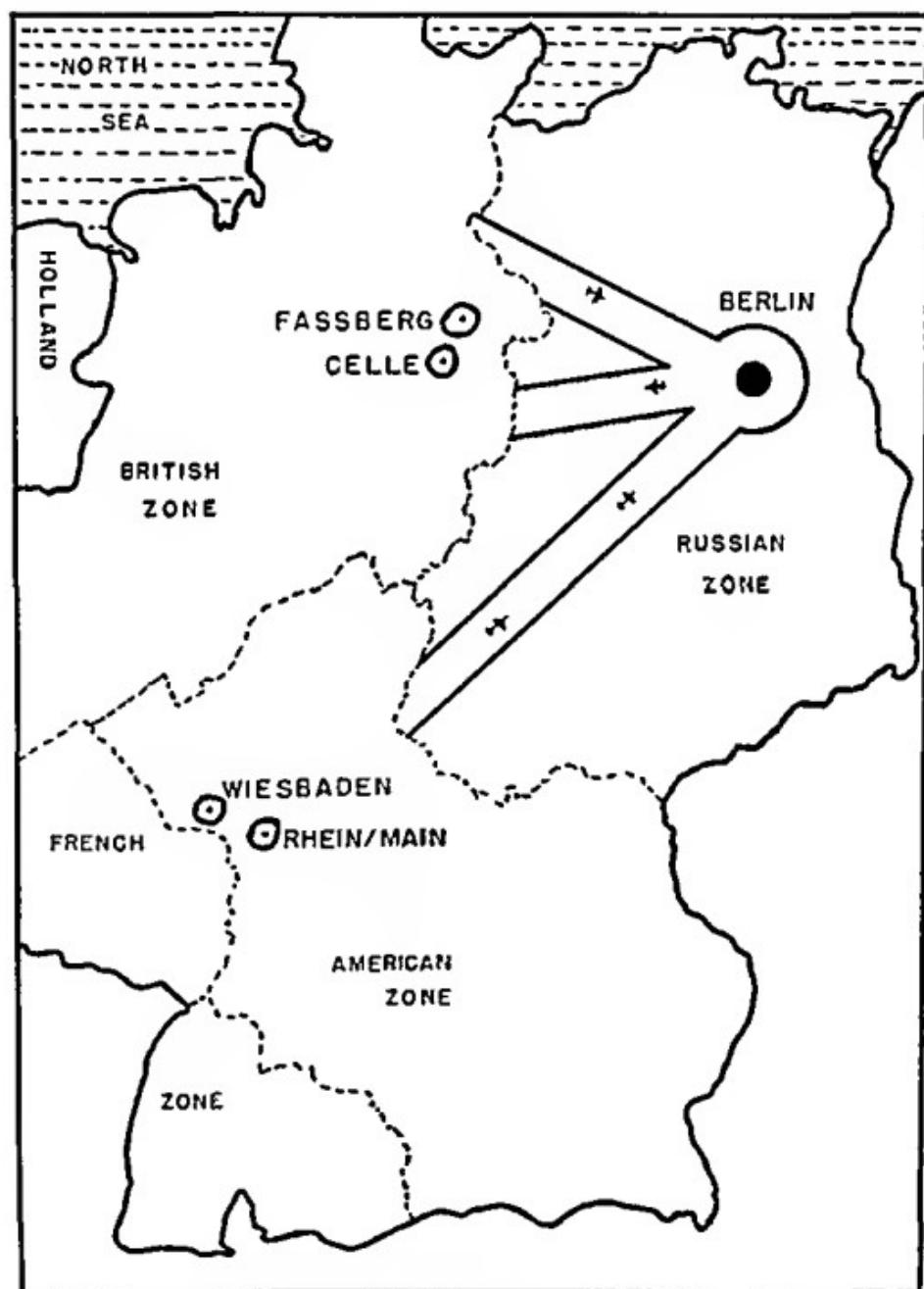


Figure 1.

(d) Other sanitary problems. On occasions the laundry facilities were inadequate. Many Airlift personnel complained of the complete absence of drinking fountains at all bases. Such problems as providing suitable garbage racks, repairing floors, painting walls, and screening doors and windows were constantly arising.

*Troop housing*.—The doubling and tripling of personnel quartered at Wiesbaden and Rhine Main Air Bases and the establishment of a troop population at Celle and Fassberg far in excess of housing facilities had a demoralizing effect. Every type of shelter was used and often distant barracks were renovated and occupied. The major problems were

(a) Inadequate rest. There was relatively no segregation of personnel according to the shifts on which they worked. This created a continual traffic, especially in the larger rooms, which made all sleepers subject to frequent disturbance.

(b) Inadequate heat: In many cases attics and hastily renovated structures were used for housing prior to the installation of adequate heat. During the colder months room temperatures were far below desirable levels.

(c) Inadequate lighting, natural and artificial, especially in attics.

(d) Inadequate furnishings: In many instances the number of occupants in a room precluded the installation of any furniture other than double-deck beds. Clothes were hung from rafters and letter writing was practically impossible.

(e) Inadequate latrine and washroom facilities: As a natural consequence of using all possible space for housing, there was a troop population far in excess of washroom and latrine facilities. Complicating this situation was a frequent lack of hot water, as the demand was far beyond the capacity of the water reservoirs or boilers.

(f) Inadequate transportation: The use of housing areas at a great distance from Airlift sites, raised a transportation problem beyond the facilities at hand. This not only caused great inconvenience, but further detracted from Airlift personnel's normal rest and recreational periods.

When conditions were at their worst, such as at Fussberg in the winter of 1948-49, rooms crowded with double-deck beds with no space for wardrobes, chairs, or tables were similar to those found in concentration camps. No base was able to solve the problem satisfactorily, although in the later stages of the Airlift, additional construction alleviated the pressure.

*Dependent housing*.—No single aspect of the Airlift was more bitterly protested than the inadequacy of dependent housing facilities. In June 1948 there were barely enough dependent quarters for the

relatively stable USAFE forces. When the USAFE troop population doubled, there was no possibility of housing dependents of all USAFE personnel. Inasmuch as the original Airlift troops arrived on temporary duty, the problem was not acute, but when it became apparent that the length of the tour was going to be prolonged and permanent change of station orders were received, the concern over dependent housing became acute. To offer some type of housing, a relatively large number of resort hotels were renovated for the dependents of Airlift personnel. This in itself, however, posed a serious problem because many such hotels were 100 or more miles from Airlift bases, making it impossible for personnel to see their dependents more than once or twice a month and then at a sacrifice of rest and sleep. The crowded conditions in dependent hotels also constituted a sanitary problem that required constant surveillance. The general effect of the dependent housing situation is indicated by the following comments from the Airlift Questionnaire.

"If personnel who are married have to remain on duty with the Airlift they should be given some consideration and action should be taken to assure that they can have their families with them. If the Airlift is worth anything to the people of the U. S., the least that could be done is to give every man the pleasure of being with his family. If this cannot be arranged, then the Airlift is depriving the personnel of the very thing they stand for, the right to live like human beings under a democracy."<sup>1</sup>

"More convenient housing for dependents would eliminate a lot of worry and mental strain among married aircrew members. The fact that our families are here and we cannot get to see them but about 24 hours out of 2 or 3 weeks does not do a thing for the morale. Our families are stuck in a hotel 100 miles from us. They live out of suitcases and if the insecurity that they are forced to live under is good for small children, I wish someone would explain it to me. I feel that we have been let down by our service very badly."<sup>2</sup>

*Aircraft.*—The Airlift was accomplished chiefly with C-54 aircraft. The C-47's originally used presented no problems other than the maintenance difficulties inherent in using a worn product intensively. The C-54 pilots frequently expressed dissatisfaction of cockpit lighting, heating, and instrument panel arrangement. Although cockpit lighting was investigated, and recommendations were made for improvement, no modification was effected during the Airlift. Opinion as to the most suitable type of earphones was varied and further investigation to produce a more comfortable soundproof earphone is

<sup>1</sup> Questionnaire 527 from a married co-pilot.

<sup>2</sup> Questionnaire 506 from a married engineer.

compute non-effective rates. Because both flying and nonflying personnel at Airlift bases were subject to similar environmental and epidemiologic factors, the report on the disability of flying personnel reflects the disability of the supporting troops. Furthermore, by taking the Care of Flyer Reports submitted by Airlift bases and comparing them with those submitted by other USAFE installations, a reasonably accurate comparison is gained as to troop non-effectiveness.

(a) *Personnel removed from flying:* The number of personnel removed from flying at Airlift bases because of disease and injury was many times more than at non-Airlift bases. The percent of personnel removed from flying each month from Airlift bases was generally in excess of 10 percent of the total aircrew strength, as compared to about 2.5 percent at non-Airlift bases. These percents represent number of removals only and do not represent off-duty time for the entire period as there is no accurate method for computing the average time lost for removal.

(b) *Removals for respiratory disease:* The predominant cause of removals was respiratory disease. The number of removals per month at Airlift bases because of these diseases and their complications, were excessive and in general, about five times higher than at non-Airlift bases (fig. 2). Furthermore, the removals for respiratory diseases do not include such complications as aero-otitis and sinusitis.

For comparative purposes, the average flying strength of Airlift personnel was about 4 times greater than that of non-Airlift personnel. Even if incapacities caused by flying at non-Airlift bases was multiplied by 4, they would fall far short of the disabilities encountered at Airlift bases (table I). Although it has been impossible to obtain facts on the number of persons who sought removal from flying because of subclinical fatigue caused under other symptoms, flight surgeons working with the Airlift stated that the number who requested relief from flying in order to rest or otherwise escape pressure of their duties, was very large, and that it was not unusual to remove persons with excessive physical fatigue under a diagnosis of common cold, or a similar elusive guise.

TABLE I.—*Removals for incapacities caused by flying*

Diagnosis	Removals at airlift bases	Removals at non-airlift bases
Terrorism	1	1
Aero-otitis	25	4
Operational fatigue	25	3

(c) *Removals for miscellaneous causes:* While respiratory disease was excessive and fatigue was an appreciable factor, other disabilities

did not materially deviate from normal expectations. Table 2 shows the number of removals during the Airlift for the more common disabilities.

TABLE 2.—*Removals of Airlift personnel from flying for miscellaneous causes, 2 July 1948 to 1 October 1949*

<i>Cause</i>	<i>Total</i>
Skin diseases.....	62
Hemorrhoids .....	23
Infectious hepatitis.....	23
Aircraft injuries.....	22
Appendicitis.....	16
Peptic ulcer.....	15
Pneumonia.....	12
Tuberculosis.....	4
Hernia.....	3
<b>Total</b> .....	<b>180</b>

*Venereal disease.*—The incidence of venereal disease among Airlift troops was excessive. Fortunately, with modern therapy there was little lost time as the majority of patients were treated on a duty status and periods of removal from flying were brief. Whether or not there have been any undesirable sequela associated with this high incidence cannot be determined at this time, but the fact that the rates were excessive was a cause for concern as it reflected adversely on the morale and discipline of the troops. The chief cause for this high incidence was the fact that persons suddenly removed from their established homes and placed in a new environment made hasty heterosexual adjustments. This is strongly supported by the marked rise in rates when new troops were brought in and the subsequent decline as readjustment took place and better control measures were effected. Also contributing to the high rate was the fact that acceptable recreational outlets were either overcrowded or could not be used because of the shifts on which many persons were working, and until they could have their off-duty time channeled into authorized recreation, there was much time spent in careless sexual pursuits. Another factor was the fact that when bases were expanded and new fields were opened, a large number of camp followers accumulated in the hope of gaining a livelihood from the American troops, self-support being difficult in a war-impoverished nation.

Attempts were made to control the number of transient women in the base areas and to treat those who were infected. Attempts were also made to control exposure but this was difficult. There was great resentment among the troops against any disciplinary measures taken when they were infected with venereal disease, and it is believed that many received treatment from outside sources. It is difficult to esti-

mate what the rate would have been had all patients reported to Air Force physicians. As dependents arrived, and as authorized recreational outlets improved, the recorded rate fell. The incidence of venereal disease in the Airlift appeared to be inversely proportional to morale and stability. Whether or not disciplinary measures were beneficial in its control is a matter of conjecture.

#### SUMMARY

The Berlin Airlift was an intensive flying mission undertaken without warning or preparation. There was a lack of housing, aircraft and equipment, and recreational and medical facilities. The effect on the health of Airlift personnel was adverse. The respiratory disease rate was five times as high, and the number of persons removed from flying because of physical disability was four times as high as among non-Airlift personnel. Various incapacities caused by fatigue, maladjustment, and low morale were also unduly high. The logistic demands of the mission required priority over the correction of the environmental problems. As a result, unsatisfactory living and hygiene conditions could not be rectified during the mission although some progress along these lines was being made when the mission ended.

#### CONCLUSIONS

1. *Dislocation*.—Sudden dislocation of troops from their homes in the early stages of the Airlift resulted in appreciable situational maladjustment. Adequate advance notice prior to transfer in order to take care of personal problems and to provide for dependents is essential to morale and stability.

2. *Overpopulation*.—The sudden increase in troop strength overtaxed housing and sanitary facilities thereby contributing to noneffective rates. Fortunately no major epidemics occurred. The construction of adequate housing and sanitary facilities before occupancy is essential to troop health.

3. *Work schedules*.—The Berlin Airlift was the first major peace-time operation conducted on a 24-hour-a-day, 7-day-a-week basis. Lack of guidance and uniformity resulted in schedules that contributed to fatigue and noneffectiveness. Schedules should be uniform, allow sufficient time off for proper rest and relaxation and should not be changed at intervals of less than 7 days, in order that troops may adapt to changes in sleeping habits. Food, medical, and laundry services should operate on schedules comparable to that of the troops they support.

4. *Recreation*.—The normal recreational outlets of Airlift personnel were blocked through schedules that did not provide for passes of 3 or more days, or did not provide for daylight off-duty time. This

contributed to fatigue, lowered morale, and probably increased the incidence of venereal disease.

5. *Flying*.—Although fear of flying or survival were negligible factors, the physiologic abnormalities of the schedules used and concern over families and personal problems contributed to fatigue, lowered efficiency, and probably contributed to aircraft accidents. Intensive peacetime flying in a low-altitude operation, even under adverse weather conditions, is not in itself detrimental to health or efficiency, provided there is reasonable environmental adjustment and adequate rest and recreation.

6. *Hospitalization*.—The existing medical facilities and personnel were not capable of providing other than dispensary-level care. This resulted in an increased noneffective rate because of the referral of patients to distant sites, and inability to give early attention to symptoms.

7. *Air evacuation*.—Scheduled air evacuation proved superior to on-call flights.

8. *Recording of troop disability*.—In an operation of major magnitude requiring extraordinary effort on the part of participating personnel, there is a point at which loss through fatigue and disability increases faster than productive results. In such a situation troop disability should be charted with logistic accomplishments.



would not have occurred or would not have been fatal without some prior condition such as malnutrition, marasmus, neglect, or ignorance.

### ETIOLOGY

Infant diarrhea is not a pathologic entity, but a miscellaneous group of diseases from known and unknown causes bound together by a common symptom, diarrhea.

*Bacterial agents*.—In addition to epidemics caused by such pathogens as the *Shigella* or *Salmonella*, epidemics have been reported in which so-called nonpathogenic organisms have been incriminated. Among these are *Pseudomonas aeruginosa*, *Proteus morganii*, the hemolytic staphylococci, Lancefield's group D streptococci (including *Str. faecalis*), paracolon organisms, and hemolytic strains of *Escherichia coli*. These organisms can usually be found in normal persons but it is believed that almost any organism can cause disease if present in sufficient numbers.

Ensign and Hunter (5) investigated a series of outbreaks of infant diarrhea in a hospital in a fairly large community in Kansas. They noted that 6 of the outbreaks had occurred in the nursery between 1 June and 1 October and involved 24 infants, 9 of whom died. Their study revealed that: (a) the outbreaks were separated by periods of 13, 7, 49, 31, and 10 days, indicating that the infection was being introduced from without; (b) no secondary outbreaks, with one possible exception, occurred in the nursery; (c) a mother or a nurse became ill before each outbreak; (d) every time a mother became ill, her child did also; (e) children on the pediatric ward would occasionally develop the disease; and (f) a generalized epidemic of diarrhea was occurring in the community at the same time.

TABLE 1.—Incidence of positive cultures for *Pseudomonas aeruginosa* in an outbreak of diarrhea

	Number	Positive culture
Infants under 1 year of age	26	26
Normal infants under 1 year of age	13	13
Patients examined after death	3	2
Nurses and other employees	103	116

1 of these became ill later.

1 nurse was also a carrier of *Escherichia coli*.

Having decided that the infection was being introduced from the community they investigated the water and milk supplies and found that the hospital and most of the community received their milk from two dairies. Investigation of these dairies revealed grossly unsanitary conditions, improper pasteurization, and plate counts of over 3 million bacteria per milliliter. In one of the dairies a water leak,

directly over one of the coolers, was partially controlled by a dirty rag. The water dripped from the rag directly into the so-called pasteurized milk. Cultures from this rag yielded *Pseudomonas aeruginosa*. Previous cultures from the infected children had yielded the same organism, but little attention had been paid to this fact. The results of thorough bacteriologic study are shown in table 1.

McClure (6) investigated a series of outbreaks of infant diarrhea in hospital nurseries and noted the greater predominance of hemolytic *Escherichia coli* in the sick than in the normal children. Of 42 patients, 15 of whom died, hemolytic *Esch. coli* were found in the stools of 34 and paracolou organisms were found in 21, whereas in 34 normal children *Esch. coli* were found in 2 and paracolon organisms in 8. Four nurses in one institution also harbored hemolytic *Esch. coli* and one of these strains was similar, biochemically, to those isolated from the infected infants. The same strain of this organism was also recovered from a bathing table on which all the infants were bathed. A bacteriologic study of the formula used revealed the presence of a nonhemolytic *Esch. coli*.

McClure attempted to demonstrate the ability of these organisms to produce a toxin by growing them in a semisolid medium, centrifuging to obtain the supernatant fluid which was passed through a bacterial filter, and using the filtrate for testing in cats. His results were not entirely conclusive, but in general the hemolytic strains of *Esch. coli* produced vomiting, diarrhea, and death in a much larger percent of cats than did the nonhemolytic strains. Mice were only slightly susceptible to the toxin, and rats, guinea pigs, rabbits, and monkeys were not susceptible.

Breast feeding is superior to bottle feeding in preventing outbreaks of epidemic diarrhea in the newborn (7). Infants need a normal "fecal-oral" transmission from the mother through breast feeding to establish a normal bacterial flora in the intestines. Aseptic feeding techniques rob the child of these normal coliform organisms, and make the child more susceptible to any pathogen he may encounter. Mayes (7) even advocates the rectal injection of a suspension of the so-called normal flora to prevent outbreaks of this disease.

*Viral agents*.—Although viruses have long been suspected as one of the causes of infant diarrhea, most of the evidence was negative, resting on the absence of a demonstrable bacterial agent, the fact that the infants involved showed a normal or subnormal leukocyte count and that the child failed to respond to chemotherapy. The first positive evidence that a filtrable virus could cause infant diarrhea was submitted by Light and Hodes (8) (9). After attempting to isolate a filtrable agent in a variety of small animals without success, they turned to the calf. Four strains of a virus that caused a bloody,

mucous diarrhea in calves and lasted about 3 weeks were readily isolated. Thirteen percent of the infected calves died. Serial transfers were readily made with all four strains. Specific neutralization of the virus was demonstrated, using the serums of infants convalescing from the disease. Cummings (10) partially confirmed this work by passing the agent serially through five calves before losing it.

Buddingh and Dodd (11) observed an outbreak of infant diarrhea complicated by stomatitis in about 30 percent of the patients, in which they successfully transferred a filtrable agent to the cornea of rabbits. They differentiated this disease from herpetic keratitis by cross-immunity tests. Buddingh (12) claims to have successfully transmitted the disease serially through 45 passages in the rabbit's cornea. Unfortunately investigators attempting to corroborate this work have not substantiated their findings. Minkeljohn (13) believes that he has duplicated Buddingh's work, but has had little success in proving, by means of the neutralization test, that a virus is present. Cummings (10) found that many nonspecific factors such as trauma, trauma plus influenza, stools and oral washings from normal persons, and various bacteria produce a keratitis in the rabbit's cornea similar to the one described by Buddingh and Dodd.

Lyon and Folson (14) witnessed 3 outbreaks of this disease in a hospital nursery in 1926, 1934, and 1938. During each outbreak, they noted that influenza was prevalent in the community. During the 1938 epidemic, involving 16 infants with 5 deaths, they assumed that the disease was caused by influenza virus and inoculated each of 3 critically ill infants with 30 milliliters of blood from an adult patient convalescing from influenza. All 3 patients improved immediately and, although the diarrhea persisted for several more days, they made an uneventful recovery. High et al (15) noted an outbreak of infant diarrhea that they suspected to be caused by a virus. At the time an epidemic of nausea and vomiting was prevalent in the community. Trying Lyon and Folson's technique, they injected the infants with blood from a convalescent adult patient, but with no success. The only results that have been confirmed are those of Lash and Hodges who worked with the calf, a rather cumbersome and expensive laboratory animal.

*Unknown agents.*—Although most of the literature on this subject deals with outbreaks of unknown cause, filth and poor nursing techniques appear to play an important part in almost every outbreak. Diapers were changed just prior to feeding; hand-washing was performed in cold or tepid water or in rinse solutions that contained as many as 7 million bacteria per milliliter, formulas were inadequately sterilized, and many other lapses in aseptic technique were noted.

### CLINICAL FINDINGS

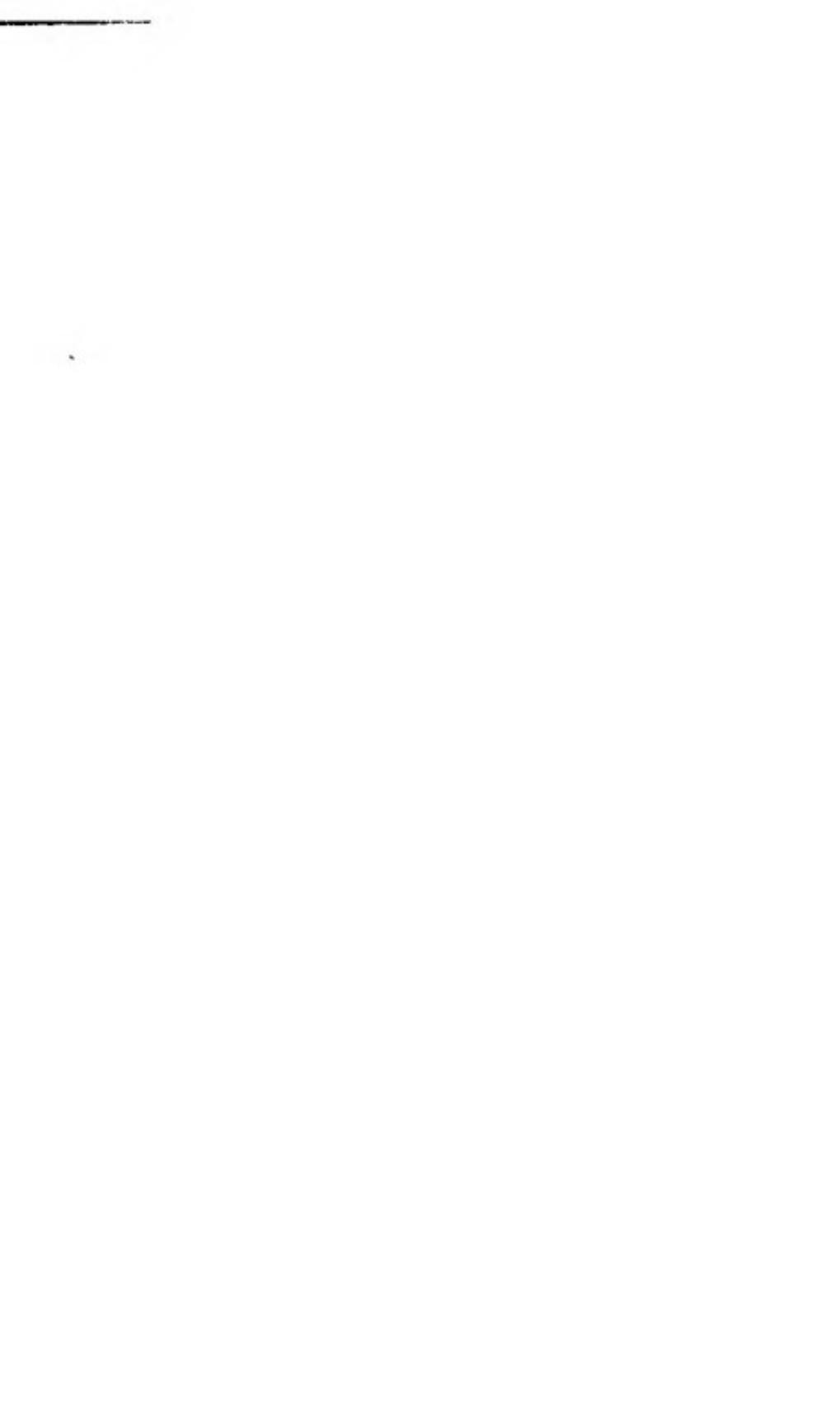
Most cases of infant diarrhea are characterized by (*a*) severe intestinal intoxication, (*b*) yellow watery stools, (*c*) abnormal distention, (*d*) rapid loss of weight, (*e*) drowsiness, (*f*) dehydration, (*g*) shock, and (*h*) in moderate to severe cases, acidosis (16). High and his group (15) added a feature that they have noted—a biphasic phenomenon in which the patient may have recurrent bouts of diarrhea and then may suddenly collapse and die. Of the 11 patients in their series who demonstrated this phenomenon, 9 collapsed suddenly and 8 died. Feldman and Anderson (16) found that the average case fatality rate reported for outbreaks of infant diarrhea was 27.8 percent; the range was from 10.5 to 81.8 percent.

### AUTOPSY FINDINGS

Most workers found no significant findings at autopsy. Many noticed a terminal pneumonia or atelectasis and a slight intestinal edema, but unusually little pathologic change for a disease with such a violent course. Christensen and Biering-Sorensen (17) believe that an encephalitis occurs in some patients and have presented the following post-mortem findings: (*a*) no evidence of intestinal infection; (*b*) fatty degeneration of the liver; (*c*) bronchitis and pneumonia suggestive of a general infection with gastrointestinal symptoms; (*d*) encephalitis; (*e*) meningitis with no inflammatory changes in the brain; and (*f*) edema of the brain. The cerebral changes may be non-specific like those of toxic encephalitis found in other diseases (18). Lyon and Folsom (19), who suspected influenza virus to be the cause of their cases of diarrhea, found severe generalized edema of the brain with many pin-point hemorrhages at autopsy. The blood vessels were unusually friable, and the convolutions of the brain were almost flattened by the edema. In the intestinal tract, the mucosa was almost completely denuded and pin-point hemorrhages were present. Generalized atony of the intestine was prevalent.

### FOURTH ARMY AREA MEDICAL LABORATORY PROJECT

We are trying to determine the agents that may cause infant diarrhea. Complete bacteriologic studies and attempts to isolate filtrable agents from cases that are probably caused by viruses are made. Table 2 summarizes our findings on the enteric pathogens. In the group studied thus far no *Shigellae* were isolated from the group 1 to 6 months old. Three children demonstrated central nervous system signs and their infection was thought to be viral. Two of these children died. One was 2 months old and had the typical stomatitis described by Buddingh and Dodd (21). The other was 4 months



# The Clinical Use of Antibiotics

## IV. Treatment of Infectious Processes<sup>1</sup>

PETER H. LONG, *Colonel, U.S.A.*

**A**T PRESENT the problem of the clinical use of antibiotics in the treatment of infectious disease is complex, and will probably become more so as new and effective agents make their appearance. This means that the medical officer must select with care and intelligence the antibiotic he plans to use for the treatment of any patient, and, in certain instances of disease, he is confronted with the problem of choosing the most effective combination from among several antibiotics. The following recommendations are based on the effectiveness of the drug, its toxicity, the ease of its administration, its cost, and the possibility of the organism becoming resistant.

*Group A hemolytic streptococcal infection.*—The antibiotic of choice is a preparation of penicillin G. Aureomycin is the second most effective agent, with chloramphenicol and streptomycin trailing. For topical use, tyrothricin or bacitracin can be recommended.

*Group B hemolytic streptococcal infections.*—Penicillin G is preferred. Aureomycin is second choice.

*Infections with Streptococcus faecalis.*—Aureomycin is the drug of choice with penicillin second.

*Infections with Streptococcus viridans.*—A preparation of penicillin G is the drug of choice with aureomycin second if the infecting organism belongs to that group of *Str. viridans* that inhabits the rhinopharynx. If the organism belongs to the enterococcal group, then aureomycin is the drug of choice.

*Nonhemolytic streptococcal infections.*—If the organism is an enterococcus, use aureomycin; otherwise penicillin.

*Staphylococcal infections.*—In view of the increasing incidence of staphylococcal infections produced by organisms that are resistant to penicillin, aureomycin is the agent of choice, with penicillin G sec-

<sup>1</sup> The fourth and last of four articles on this subject.

<sup>2</sup> Department of Preventive Medicine, Johns Hopkins University School of Medicine, Baltimore, Md.

gastrointestinal illness. The cultures were made as promptly as possible and more often than usual. Of the 5 ships included in the project, 3 were decommissioned prior to the scheduled termination dates of the study; operational plans for another vessel made it impracticable to obtain the last 2 scheduled cultures. The numbers of post-inoculation cultures actually obtained on the cruisers were, therefore, 12, 15, 19, 24, and 26 respectively.

The technical procedures followed and materials employed were described in another article (1). Of importance in the interpretation of results were histories of previous exposure to infection with *S. flexneri III*, ship's division to which a man was assigned, and whether the subject represented an "original" or "replacement" in the project; replacement personnel were those who reported aboard the vessels subsequent to initiation of the program on the ship and such persons were excused from the routine preinoculation studies.

## RESULTS

Five thousand, eight hundred and sixty officers and men were included in the studies of this number, 3,582 (60.3 percent) were originals and 2,328 (39.7 percent) were replacements; this study classification is shown in table 1. There were 106 intership transfers of personnel during the course of the program.

TABLE 1 - STUDY CLASSIFICATION OF OFFICERS AND MEN ON 5 CRUISERS

Ship	Originals		Replacements		Total
	Number	Percent	Number	Percent	
A	656	35.6	433	41.4	1,117
B	55	35.7	62	41.3	1,225
C	23	35.2	541	42.5	1,394
D	26	33.4	99	36.6	1,117
E	62	35.1	325	31.9	1,027
Total	3,582	60.3	2,328	39.7	5,910

In all, there were 10,518 preinoculation cultures and 86,587 post-inoculation cultures scheduled for the group of subjects, an anticipated total of 97,105 specimens. Actually, there were 8,503 preinoculation, and 75,784 postinoculation, rectal swab specimens taken, or 82,589 cultures examined; these represent 85.1 percent of those scheduled. Of the entire number of specimens taken, 411 cultures positive for either *Shigella* or *Salmonella* were obtained from 190 asymptomatic subjects or 3.2 percent of the study population.

*Asymptomatic carriers of S. flexneri III*—Of critical importance in the study is the fact that *S. flexneri III* was recovered at least once from 103 subjects, or 54.2 percent of the persons with cultures positive

for the 2 genera previously mentioned; this group of carriers comprises 1.8 percent of the total population studied. The majority of the carriers was concentrated on 2 of the 5 ships: the distribution was Ship A, 9; Ship B, 42; Ship C, 41; Ship D, 6; and Ship E, 5. At the termination of the studies, because of decommissioning, there were 1,955 officers and men still aboard Ships B and C of whom 62, or 3.1 percent, were carriers of *S. flexneri III*. The possible epidemiologic significance of this situation will be discussed later. Two hundred and sixty cultures of *S. flexneri III* were recovered from the group of 103 carriers; that is, 63.3 percent of all positive cultures recovered from 190 subjects were *S. flexneri III*. A summary of the cultural studies of the *S. flexneri III* carriers is given in table 2.

An examination of this summarization reveals some interesting observations. It will be noted that 90 (87.4 percent) of the group were originals; that is, they were aboard when the program was begun. Of particular importance is the fact that 87 (84.5 percent) of the subjects reported their presence in a previous epidemic presumably caused by *S. flexneri III*; 51, or 49.5 percent, of them had been ill at the time of the outbreak, but only 9 of the 103 had records of previous cultures positive for the organism. Of the entire group, 16 (15.5 percent) were detailed to food-handling duties during periods when *S. flexneri III* was isolated from them. Some additional evidence of the intermittent shedding of the organism was obtained; it was recovered only once from 48 subjects but in the remaining group of 55 subjects from whom *S. flexneri III* was obtained 2 or more times the largest number of negative cultures between positives was 21. The highest number of consecutive positive cultures isolated was 7, but from one person there were 12 positive cultures with only 3 negative specimens intervening. From the group of 103 carriers, 1,259 specimens were secured for culturing; of these, 260 or 20.7 percent were identified as *S. flexneri III*. *S. flexneri II* was recovered from 2 men subsequent to the isolation of *S. flexneri III*. From 1 specimen from one of the subjects, a mixed infection of *S. flexneri III* and *S. dyspar III* was demonstrated. From another person, *S. alkalescens* was recovered 7 weeks subsequent to the isolation of *S. flexneri III*; no additional positive cultures were obtained from this man in 19 successive attempts.

A careful examination of the case histories of the 16 asymptomatic carriers of *S. flexneri III* who denied being present in a previous epidemic elicited further pertinent information. Nine of them had only recently started their naval careers, their ages ranged from 17 to 19 years, and only 1 had had previous sea duty. Of 8 who had had previous sea duty and whose ages varied from 19 to 31 years, 7 had been aboard ships that either were known to have suffered previous-

epidemics or had visited ports where the infection could have been acquired; it was believed that information furnished by the other subject was erroneous and that he was actually present in a previous epidemic. Thirteen of this group of 16 carriers were assigned to ships' divisions in which there was at least 1 other carrier who had been present in a previous epidemic. It is possible to speculate only as to the sources of infection in these 16 men; it is believed, however, that circumstances could have permitted 8 of them to acquire the organism after reporting aboard the ships in the study. Of these 8 men, 3 received parenteral *S. flexneri III* vaccine; the first positive cultures were obtained from 2 men prior to completion of the courses of vaccine. The first positive culture from the third man (D 770) was recovered, however, 26 days after completing the course of vaccine. Unfortunately, no postinoculation serum was obtained from this man and consequently no serum mouse protection studies were made; however, agglutination tests with two postinoculation serums showed titers of 640 and 320 respectively, neither of which indicates a significant rise above the "normal" level (4). Two others of this group of 8 had received oral *Shigella* vaccine with intervals of 4 and 11 days after completing the course before the first positive culture was isolated; the other 3 men had received placebos only. A condensation of the data concerning these 16 men is presented in table 3.

TABLE 3.—Historical data concerning 16 men who denied presence in previous epidemics of diarrheal disease

Study number	Age (years)	Study classification	Vaccine		Date entered Navy (month and year)	Date aboard ship (month and year)	Previous sea duty	Date of first positive culture
			Kin I	Date course completed				
B 3157	18	Replacement	Pa <sup>1</sup>	11-1-45	8-45	9-45	None	10-25-45
C 13	19	do	Pa <sup>1</sup>	12-16-45	8-45	11-45	None	12-11-45
B 1098	18	do	Or <sup>2</sup>	10-21-45	8-45	9-45	None	10-25-45
C 1276	17	do	Or <sup>2</sup>	10-21-45	8-45	9-45	None	11-1-45
C 1224	17	do	111 <sup>3</sup>	10-11-45	8-45	9-45	None	12-2-45
C 1070	19	do	Pt <sup>4</sup>	9-30-45	2-45	9-45	None	11-1-45
B 881	19	do	Pt <sup>4</sup>	10-21-45	10-45	9-45	1947-45	11-21-45
C 922	21	do	Or <sup>2</sup>	9-30-45	12-45	8-45	1947-45	12-14-45
C 1463	20	do	Or <sup>2</sup>	9-30-45	10-45	9-45	1949-45	11-1-45
A 171	26	Original	Pt <sup>4</sup>	5-25-45	9-45	8-45	1945-45	6-12-45
C 212	21	do	Pt <sup>4</sup>	7-6-45	9-45	9-45	1945-45	6-17-45
C 236	22	do	Pt <sup>4</sup>	7-7-45	3-45	7-45	1945-45	10-5-45
C 412	21	do	111 <sup>3</sup>	7-7-45	5-45	7-45	1949-45	8-10-45
D 770	17	do	Pa <sup>1</sup>	8-24-45	10-45	5-45	None	6-25-45
E 120	18	do	Pt <sup>4</sup>	7-26-45	11-45	3-45	None	9-27-45
E 118	24	do	Or <sup>2</sup>	7-26-45	1-45	3-45	1945-45	9-1-45

<sup>1</sup> Parenteral *S. flexneri III* vaccine.

<sup>2</sup> Oral *Shigella* vaccine.

<sup>3</sup> Placebo.

*Asymptomatic carriers of Shigella alkalescens.*—Of interest is the number of times *S. alkalescens* was isolated during the studies; it was recovered from 127 specimens taken from 69 asymptomatic subjects. A total of 1,174 specimens for culturing was obtained from these

subjects; the number of cultures positive for *S. alkaliscens* represented therefore, 10.8 percent of those taken from this group. From the total of 411 cultures of *Shigella* and *Salmonella* isolated during the study, those positive for *S. alkaliscens* comprised 30.9 percent in contrast to 63.3 percent positive for *S. flexneri III*. *S. alkaliscens* was recovered only once from 46 persons, twice from 9 others, 3 times from 7 individuals, and 11 times from 1 man. The greatest number of negative cultures between positives was 16, and the highest number of consecutive positive cultures was 5. Twenty of the sixty-nine persons reported their presence in a previous epidemic (presumably due to *S. flexneri III*) and 7 of them stated they were ill during the outbreak.

*Miscellaneous Shigella and Salmonella types isolated*.—There was a total of 20 cultures of *Shigella* and *Salmonella* types, other than those already mentioned, recovered from 19 different persons. *S. flexneri II* was encountered in 2 consecutive specimens from 1 of these subjects who denied any history of gastrointestinal illness or presence in an epidemic; this type was recovered from another man subsequent to the isolation of *S. flexneri VIII*. *S. flexneri VII* was recovered once from a person who had been aboard a ship during an outbreak in October 1947 and who had been ill for 3 days at that time. *S. rio* (5) was identified in a single specimen from a man who gave a history negative for diarrheal disease or presence in an epidemic. *S. sonnei* was isolated once from 1 subject who had been present and ill for 10 days during a shipboard outbreak in October 1947. Of 12 individuals from whom *Salmonella* types were isolated, 9 denied any history of gastrointestinal illness or presence in an epidemic; the organisms, which were recovered only once from each subject, were *S. anatum*, *S. bredeney*, *S. jariana*, *S. monterideo*, *S. newport*, *S. oranienburg*, and *S. typhimurium*.

*Sporadic cases of gastrointestinal illness*.—During the course of the project, there were 65 sporadic cases of gastrointestinal illness reported from 4 of the 5 ships. A total of 165 specimens taken from 59 cases during illness yielded no cultures positive for *Shigella* or *Salmonella*. Of these 59 subjects, 38 were originals and 21 were replacements; in none of the persons was the illness severe and the average duration was approximately 1.5 days. Only 7 of the 65 sporadic cases were foodhandlers and all 7 were among the 59 with transient illness just described.

Of importance is the fact that from each of the other 6 cases, *S. flexneri III* was recovered on at least 2 days during the illness, with 7 as the maximum number of positive specimens; no other type of *Shigella* or *Salmonella* was encountered in any of the specimens examined. Three of the cases occurred on Ship B and 3 were on Ship C; it is of interest to note that these 2 cruisers had the highest asymptomatic

onset of illness respectively. Unfortunately, no adequate data are available at present to determine whether sufficient immunity should have been developed in these two patients to protect them against infection; further studies are planned in an attempt to collect more evidence on this point. It appears possible that these six cases might have been an indication of impending epidemics on the two cruisers, particularly on Ship C where three cases occurred within 9 days; this question remains unanswered, however, since both vessels were decommissioned shortly thereafter.

Of possible significance is the fact that in these studies there was no definite evidence of failure of the parenterally administered *S. flexneri III* vaccine to produce the desired results; none of the six sporadic cases of illness had received this type of material. Of the eight asymptomatic carriers who could have acquired their infections after reporting aboard the study ships, three had been given the vaccine subcutaneously; from two of these, however, the first positive cultures were recovered prior to completion of the immunization process. The first positive culture was obtained from the remaining patient, however, 26 days after the last dose in his course of vaccine; it is possible that this instance represents a failure of the vaccine to prevent infection. It is equally possible that the man had actually acquired his infection aboard the ship prior to being inoculated; there was an interval of about 6 weeks during this period when no specimens were taken from him for culturing. On the basis of data at hand, this case does not represent a failure of the vaccine to prevent illness due to the infection. It is hoped that analysis of data to be collected may provide more adequate evidence concerning this question.

#### SUMMARY

From 5,860 officers and men aboard 5 light cruisers, a total of 84,589 rectal swab specimens was taken before and after administration of *S. flexneri III* vaccines and cultured for members of the *Shigella* and *Salmonella* groups; 411 strains of organisms belonging to these 2 genera were isolated from 190 (3.2 percent) of the personnel studied.

*S. flexneri III*, the *Shigella* type predominantly responsible for recurrent shipboard epidemics in the Pacific Fleet, was recovered 260 times from 103 asymptomatic carriers; this group represents a carrier rate of 1.8 percent. It was shown that about 85 percent of these persons had been present in a previous epidemic of shigellosis at which time the carrier condition presumably was initiated; it was believed that the bilance of the group became infected as a result of exposure to organisms excreted by the established carriers. Intermittency in the recovery of *S. flexneri III* from carriers was again observed. The

majority of the carriers (80.6 percent) was concentrated on two of the ships on which six sporadic cases of illness due to this organism occurred just prior to decommissioning of the vessels.

Suggestive but inconclusive evidence was obtained which indicated that the parenterally administered *S. flexneri III* vaccine had produced the desired results; analyses of additional data are planned with the objective of obtaining more definite information on this point.

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are not aware of three types previously being isolated from one patient. The man from whom the organisms were isolated had had an attack of dysentery 10 weeks earlier but had not been hospitalized. It is possible that he was harboring one or more of the types in the interim and had been the victim of a reinfection at a later date. Since multiple infections can confuse any definitive epidemiologic studies, the value of selecting several colonies for study is evident. Three subsequent stool specimens, taken at 4-day intervals following sulfonamide therapy, revealed only the Types I, III organism, although 20 or more colonies were selected for study.

# Mental Reactions of the Airborne Soldier

ROBERT BERNSTEIN, *Captain MC U S A<sup>1</sup>*

THE airborne soldier is a volunteer. For this reason, it is often assumed that any basis for unwillingness or fear of parachute jumping is eliminated. In this connection it is interesting to note the reasons offered by troops volunteering for the airborne ranks: (a) Some seek parachute training out of curiosity; (b) some undergo the training as a challenge, to see if they are able to complete it; (c) many men seek the training solely to earn the extra pay offered; (d) a small group desire to become airborne for the sake of prestige, the reasons being vague in details but strongly felt; and (e) many men ask for airborne training under the strong influence of a relative, friend, or even a recruiting officer. This last group appears to furnish the greatest number of jump refusals, as well as most of the psychogenic problems encountered.

The initial test of the airborne soldier's ability to maintain emotional stability begins the first day of his training when he commences a long period of fatiguing physical conditioning. This conditioning is purposely emphasized in order to "separate the men from the boys." It is during this stage, while the student is laboring over his fiftieth "push-up," that his instructor offers the consolation, "It's all a matter of mind over matter. We don't mind and you don't matter." It is also during this stage that word "quitter" is first brought into the man's working vocabulary. This word serves as a means of branding vividly the man who chooses to discontinue parachute training, and is held over his head throughout the rest of his airborne life. This attitude plus the hazing practiced make it difficult for a man to consider discontinuing his training, once he has begun. Thus many an impressionable young man continues his training in order to avoid the chagrin and disrespect showered on a quitter and thereby unsuitable candidates may be forced into the airborne ranks. This unsuitability may

<sup>1</sup> 11th Airborne Division

a general feeling of tension. A soldier undergoing such an experience may appear calm, or the increased tension may be obvious. This tension differs with each person, and is essential in maintaining the proper degree of mental acuity. Regardless of whether one admits being afraid, the previously described sensations, at least in part, are experienced by all. The tension produced and the tremendous amount of energy thereby expended bring to light a serious problem. Parachute jumps in training, and even more significantly in combat, usually take place about dawn or earlier. This is usually necessary for tactical purposes and because ground winds are apt to be less active at that time. This necessitates waking the soldier at 0200 or 0300 hours. Rarely can one adequately compensate for this loss of sleep. This factor alone jeopardizes the high standard of physical stamina sought in the soldier, but when coupled with the tremendous energy drainage resulting from the anxiety and tension present, the soldier is apt to be considerably beneath his normal physical status. In fact, on completion of the landing, the man experiences profound fatigue. For this reason, he often must be driven to vacate the drop field and assemble with the other troops. This is not a desirable situation because his most important tactical duties follow the actual jump. In other words the stress of the jump and fatigue produced often cause the soldier to believe that his task is completed as soon as he lands on the ground. Further study and consideration of this problem is indicated. The development of means of preventing the condition discussed as well as means of revitalizing the soldier after landing presents a distinct challenge to the field of airborne medicine.

#### SUMMARY

Paradoxically many emotionally immature or unstable soldiers improve their personalities and bolster their confidence by completing parachute training. They are, however, usually poor risks and it is much safer to overlook certain physical deficiencies than any clinically significant emotional defects.



# Adenocarcinoma of the Second Portion of the Duodenum

ALLAN R. RAMSAY, *Colonel, MC, U. S. A.<sup>1</sup>*  
RUSSELL E. GRAF, *Captain, MC, U. S. A.<sup>2</sup>*

LESS than 450 cases of carcinoma of the duodenum had been reported in the literature through 1946. A case which was diagnosed roentgenologically prior to operation, and illustrates the difficulty of definitive management after the diagnosis was suspected, is presented.

## CASE REPORT

A 33-year-old white man was transferred to this hospital from the European Command on 31 August 1948 complaining of pain in his abdomen, weakness, lack of appetite, and intermittent fever. He had been in good health until June 1947. At that time he noticed a burning pain in the left upper abdominal quadrant that was aggravated by ingesting fruit juices, spicy or greasy foods, and by smoking. The pain was relieved by antacids. In October he was admitted to a general hospital in Europe for gastrointestinal studies. The roentgenograms suggested a diagnosis of gastritis. Early in November, after symptomatic improvement, the patient was returned to duty.

He was admitted to a station hospital in May 1948 complaining of anorexia and cramplike pains high in the right side of the abdomen, precipitated by ingesting food. Roentgenograms again showed gastritis. At this time the erythrocyte count was found to be low. The patient was given a bland diet, tincture of belladonna, and barbiturates. Because his symptoms had become worse and he had lost 35 pounds within the year he was transferred to a general hospital in July for further study. Here a gastrointestinal series demonstrated a 25 percent retention of the barium meal on the 4-hour roentgenogram and he was returned to the United States.

<sup>1</sup> Oliver General Hospital, Augusta, Ga.

proved discouraging. Berger and Koppelman<sup>4</sup> reported 5-year cures in only 5.2 percent. Carcinoma of the duodenum is a disease that must be kept in mind if these patients are to be sent to the surgeon while they are still operable.

<sup>4</sup> BERGER, L. and KOPPELMAN, H.: Primary carcinoma of duodenum. *Ann. Surg.* 114: 718-730, Nov. 1942.

# Isolated Fat Replacement of Body and Tail of Pancreas

## Report of a Case

ERNEST S. REDFIELD, JR., Lieutenant, junior grade, U.S.N.C.

**A**N INSTANCE of virtually complete fat replacement of the body and tail of the pancreas with only a few scattered islets of Langerhans present, in association with a normal pancreas at head and neck, was observed at autopsy on an obese diabetic man. Reference to the literature (1) (2) (3) (4) revealed only four cases all in children, in which the acinar tissue of the pancreas was entirely replaced by adipose tissue. In our patient the fat replacement was limited to a portion of the pancreas, and it is this unique feature which prompted the following case report.

### CASE REPORT

**Clinical summary.**—A 75-year-old Negro was first admitted to the hospital in October 1943 because of an infection in the small toe of the right foot. He had been diabetic for several years and also had senile dementia. The infection in the toe progressed in spite of conservative therapy so that in November a suprakondylar amputation of the right leg was done. Arteriosclerosis with occlusion of the popliteal artery and one of its branches was found. Healing of the stump was uneventful.

In the late summer of 1944, the left foot became similarly affected. The infection progressed despite conservative therapy and in September 1944 a suprakondylar amputation of this limb was performed. Pathologic changes similar to those in the right leg were found. Again recovery was uneventful and the stump healed well.

Insulin requirements were described as "moderate" except during episodes of infection. An episode, described as a possible cerebrovascular accident, characterized by stupor, stiff neck, and inability to speak, occurred in March 1945. The patient recovered within a few days. In January 1947, albuminuria with casts occurred and continued until death. There were frequent episodes of watery diarrhea during his hospitalization. The clinical diagnosis of intercapillary glomerulosclerosis was considered although no definite hypertension was present.

The patient's mental condition gradually deteriorated. On 21 January 1948, his insulin requirement suddenly increased. Leucopenia had developed,

\*Resident in Pathology, U. S. Naval Hospital, St. Albans, Long Island, N. Y.

the resection of the antrum and sparing all of the teeth, a wide resection of the lower nasal wall, including the entire inferior turbinate, was performed. A large opening into the nose was left, and the opening in the anterior wall of the antrum was closed by approximating the mucosa with interrupted silk sutures. Then through an external fronto-ethmoid-sphenoid approach on the right side, an attempt was made to resect all affected areas. However, the lesion had spread from the frontal sinus to the floor of the anterior fossa of the skull and no further surgery was indicated. The ethmoid labyrinth was then resected, leaving the middle turbinate intact. The firm tumor involved the entire ethmoid labyrinth and extended posteriorly to involve the sphenoid. Surgery was not extended beyond the ethmoid capsule because the uselessness of further intervention was quite apparent by this time. A poor result was expected from the operation because complete removal of the lesion was not accomplished in any direction.



Figure 1.—Proliferation of fibrous tissue, with a tendency to whorl, about which are bony lamellae.

The tumor tissue everywhere was quite firm, resembling somewhat the type of bone encountered in a sclerotic mastoid in a young child. A gritty sensation was imparted to the curet.

Histologic examination revealed dense fibrous tissue undergoing metaplasia with osteoid tissue and adult bone formation. A diagnosis of spongy osteoma, probably representing an advanced type of ossifying fibroma, was made (figs. 1, 2, and 3).

Convalescence after the operation was complicated by lacrimation from the right eye, evidently caused by interference with the nasolacrimal duct, and by a prolonged discharge from an oro-antral fistula which developed in the anterior wall of the antrum. A small piece of Iodoform gauze was eventually recovered from the posterolateral recesses of the antrum, and the foul discharge ceased.

The incision however, persisted for a long time in spite of dilatation of the nasolacrimal duct, and the use of mildly bacteriostatic collyria.

On 7 September 1949 the thickened and moderately deviated nasal septum was resected and a submucous resection of the right middle turbinate which appeared to be undergoing bony enlargement, was performed. Convalescence was uneventful. The histologic examination of the bone from the middle turbinate revealed the same type of fibrous tissue metaplasia with bone formation similar to that found in the specimens removed from the right maxilla and frontal bones. A diagnosis of spongy osteoma or ossifying fibroma was offered by the pathologist. Surprisingly enough, specimens of bone from the nasal septum showed the same pathologic changes whereas specimens of septal cartilage were normal except for one small area where there was minimal replacement of cartilage by fibrous tissue.

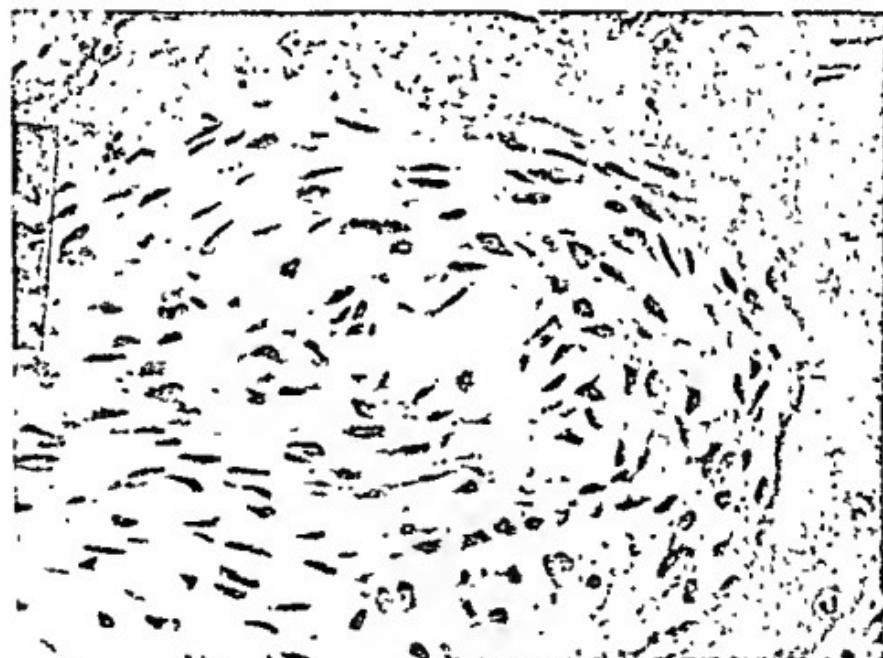


Figure 2.—Detail of figure 1. Note the abundant collagenous tissue.

Healing of the mucous membrane remnant of the right middle turbinate proceeded rapidly. The patient then had very few complaints. However, because all tissue that had been removed had shown actively proliferating osteoblasts, and because the involved areas of the skull were located in regions where vital structures could be interfered with, it was apparent that all efforts should be directed toward arresting the local proliferative process. On the advice of the consultant,<sup>1</sup> a daily dose of 25 mg. testosterone with calcium in oil was given to the patient by intramuscular injection. After 2 weeks of this therapy there was an increase in the sexual libido but this leveled off as treatment continued. There was an increase in the pubic e-cutcheon and some scattered hairs appeared on the chest.

<sup>1</sup>Dr. Charles F. Geschickter, Consultant in Pathology to the Naval Medical School, National Naval Medical Center, Bethesda, Md.



Figure 3.—In the center there is a membranous bone formation in an area of proliferating connective tissue. In the lower right-hand corner is older bone.

On 4 October 1949 the mucosal remnant of the right middle turbinate was removed. On histologic examination metaplastic bone formation was noted in the dense fibrous tissue. The pathologist suggested that this might represent a diathermia in which connective tissue metaplasia to bone occurred as a result of trauma. No further surgery has been done following this report.

At the present writing the prominence of the right half of the face is less than it was on admission. The patient is asymptomatic and blood chemistry and urinalysis are normal. If this condition is a localized disarrangement of collagenous tissue, it may be desirable to use the ACTH factor or cortisone if any further evidence of growth is noted.



# Complications of Meckel's Diverticulum

## Report of Nine Cases

LEWIS L. HAYNES, *Commander, MC, U. S. N.*  
PHIL D. CRONEMILLER, *Lieutenant, MC, U. S. N.*

EARLY descriptions of intestinal diverticula were made by Haldanus in 1598 and by Lavater in 1671. Fredericus Ruysch in 1707 gave us the first description of a diverticulum of the ileum. Morgagni in 1769 described intestinal diverticula and probably was the first to ascribe to them a congenital origin. Meckel, in three articles (1808 to 1815), discussed the embryology and significance of the diverticulum which bears his name.

### INCIDENCE

It is estimated that Meckel's diverticulum occurs in from 1 to 3 percent of all persons.<sup>1-3</sup> Howell<sup>4</sup> gives these figures from 1934 to 1944 at Duke University: Of 122,490 admissions there were 61 Meckel's diverticula, an incidence of 0.05 percent. In 3,522 autopsies a Meckel's diverticulum was discovered 3 times, an incidence of 0.08 percent. Howell's patients ranged in age from 4 months to 61 years with 50 percent in the second decade; this coincides with the findings of most authors. Meckel's diverticulum is three times more frequent in males than in females.

### EMBRYOLOGY

At about the third week of embryonic life, the embryonic disk, on cross section, occupies about one-fourth of the circumference of the

<sup>1</sup> HABER, J. J. Meckel's diverticulum: review of literature and analytical study of 27 cases with particular emphasis on bowel obstruction. *Am J Surg* 73: 458-455, Apr 1947

<sup>2</sup> CHRISTO, A. Meckel's diverticulum, pathologic study of 63 cases. *Am J Dis Child* 42: 544-553, Sept 1931

<sup>3</sup> GOODMAN, B. A. Meckel's diverticulum: its incidence and significance in routine operations on abdomen. *Arch Surg* 36: 144-162, Jan 1938.

<sup>4</sup> HOWELL, L. M. Meckel's diverticulum, consideration of anomaly, with review of 61 cases. *Am J Dis Child* 71: 363-377, Apr 1946

yolk sac. As development continues, with elongation and infolding of the embryonic disk, part of the yolk sac is incorporated within the embryonic disk forming the intra-embryonic portion of the yolk sac which later becomes the alimentary tract. With continued infolding of the embryonic disk and the rapid growth of adjacent structures the remaining (extra-embryonic) portion of the yolk sac becomes differentiated from the intra-embryonic portion and diminishes in size. With further growth of the surrounding structures the body stalk forms and later develops into the umbilical cord. In this process most of the extra-embryonic portion of the yolk sac becomes transformed into a tube called the vitelline duct or yolk stalk lying within the umbilical cord. By the sixth or seventh week the vitelline duct (yolk stalk) usually undergoes complete obliteration up to its intra-embryonic connection with what later becomes the small intestine. However, in about 3 percent of cases continuation of the intra-embryonic portion persists as a diverticulum from the small intestine. Meckel's diverticulum, situated about 3 or 4 feet above the ileocecal junction

#### ANATOMY

A typical Meckel's diverticulum is 5 cm. in length, cylindrical in form, with a tapering tip and a broad base about the size of the lumen of the ileum. It is situated in the terminal ileum, about 20 inches proximal to the ileocecal valve, opposite the mesenteric attachment. The blood supply may come either from the adjacent intestinal wall or through an independent mesentery of its own.

Variations from this typical picture are infinite. Meckel's diverticulum has been described as varying in size from a tiny out-pouching to a huge viscus, filling half the abdomen.\* Some investigators believe that these giant diverticula are remnants of both the yolk stalk and yolk sac. The distance from the ileocecal valve has been reported as varying from a few centimeters to 192 centimeters, and has been described as occurring in duodenum, jejunum, and colon, as well as throughout the ileum. It has been described as occurring on the mesenteric border of the ileum.<sup>6</sup>

#### HISTOLOGY

The usual diverticulum is lined with mucosa of the same pattern as the ileum. Often there are nests of heterotopic tissue. Figures on

\* TATE H H. • Remarkable Meckel's diverticulum. Brit J Surg 17: 456-462, Jan 1930.

<sup>6</sup> PAULS G E. Intramucosal Meckel's diverticulum. Memphis M J 22: 45-46, Mar 1947.

the incidence of this vary and must be interpreted according to the origin of the cases; that is, whether they are discovered at laparotomy or incidentally at autopsy. The usual order of incidence of aberrant tissue is gastric, then pancreatic, rarely duodenal or colic, and very rarely bile ducts.<sup>4</sup> The incidence of aberrant tissue in Meckel's diverticulum varies from 12 to 60 percent, most investigators giving about 16 percent gastric mucosa and 3 to 4 percent pancreatic tissue.<sup>4-10</sup>

### PATHOLOGY

The presence of an anomalous Meckel's diverticulum may be considered abnormal, but it does not become the concern of the patient or physician until pathologic complications occur.

Cases which occurred over an 18-month period (January 1946 to July 1947) in the U. S. Naval Hospital, Philadelphia, Pa., and reported here, are illustrative of the usual pathologic complications.

### CASE REPORTS

#### *Meckel's Diverticulum as an Incidental Finding*

The anomaly has been found during exploratory laparotomy as an incidental finding, and the ileum should always be examined for its presence.

**Case 1**—A 30-year-old white man was admitted on 15 October 1946 complaining of generalized abdominal pain shifting to the right lower quadrant, nausea, and constipation. His temperature was 100.6° F. Examination of the abdomen revealed tenderness, rigidity, and rebound tenderness in the right lower quadrant of the abdomen. The rectal examination was negative. There was leukocytosis. At operation a gangrenous appendix was removed through a McBurney's incision. A Meckel's diverticulum measuring 2 by 5 centimeters was found and excised 30 inches from the ileocecal valve. Pathologic examination revealed no evidence of inflammation but gastric mucosa was demonstrated.

**Case 2**—A 34-year-old white man was admitted on 26 May 1947 complaining of generalized abdominal pain which had shifted to the right lower quadrant. There was nausea and anorexia. His temperature was 99° F. Examination of the abdomen revealed tenderness, rebound tenderness, and rigidity over McBurney's point. There was leukocytosis. At operation, an acutely inflamed appendix was removed through a McBurney's incision. A benign Meckel's diverticulum was found and excised 18 inches from the ileocecal valve.

\*KIRKTON, A. R., and CRAVEN, A. E.: Heterotopic gastric mucosa and reduplications of intestinal tract. Am J Surg 49: 342-370, Aug 1940.

<sup>1</sup>MATT, J. G., and TIMMINS, P. J.: Peptic ulcer of Meckel's diverticulum; case report and review of literature. Am J Surg 47: 612-623, Mar 1940.

<sup>2</sup>GREENBLATT, R. R.; PISNO, E. B.; and CHANNET, B. H.: Meckel's diverticulum—analysis of eighteen cases with report of one tumor. Am J Surg 31: 285-293, Feb 1936.

<sup>3</sup>TROLL, M. M.: Aberrant pancreatic and gastric tissue in intestinal tract. Arch Path 33: 375-380, Dec 1944.

**Case 3**—A 26-year-old white man was admitted on 9 January 1947 with a 2-year history of five episodes of right lower quadrant pain lasting for 24 hours. The physical examination and roentgenologic studies were negative. Because he was an officer on independent duty, it was decided to perform an interval appendectomy. At operation a normal appendix was removed. Exploration of the terminal ileum revealed a Meckel's diverticulum with a 1-inch base. The diverticulum was excised and the pathologic examination revealed evidence of chronic inflammation.

### *Hemorrhage and Ulceration*

In melena of undetermined cause, Meckel's diverticulum should be considered, particularly in the presence of negative gastrointestinal studies. Bleeding from ulceration is one of the more frequent complications of this anomaly and often occurs from a peptic ulcer arising in aberrant gastric or duodenal mucosa.

**Case 4**—A 28-year-old white man was admitted on 1 May 1947 with a 10-year history of six episodes of weakness, tarry stools, and an occasional burning sensation in the left upper quadrant of his abdomen. The present episode began 24 hours before admission. Gastrointestinal studies, barium enema, sigmoidoscopy and esophagoscopic examinations were negative for pathologic changes. On admission his red blood cell count was 3,400,000, the hemoglobin 10 grams. His red blood cell count decreased to 2,600,000 before the hemorrhage ceased. After repeated blood transfusions an exploratory laparotomy was performed and a 5-centimeter Meckel's diverticulum was found and resected 20 inches from the ileocecal valve. The pathologic examination revealed a peptic ulcer in aberrant gastric mucosa. A 2-year follow-up showed complete postoperative relief of previous complaints.

### *Inflammation*

Meckel's diverticulitis is difficult to differentiate from acute appendicitis and when there are insufficient appendiceal pathologic changes to account for the clinical findings a careful search should be made for a Meckel's diverticulum.

**Case 5**—A 19-year-old white man was admitted on 17 September 1946 with a 4-day history of right lower abdominal pain, diarrhea, and vomiting. There was some dysuria. The physical examination revealed generalized abdominal muscle guarding with right lower quadrant tenderness and rebound tenderness. Hyperperistalsis was present. The white blood cell count was 5,700 with a normal differential count. He was observed for several hours, but when his symptoms increased, an appendectomy was performed through a McBurney's incision. A normally appearing appendix was removed. Eighteen inches from the ileocecal valve an acutely inflamed Meckel's diverticulum with the tip adherent to a loop of ileum, was found and excised. The pathologist's report revealed a normal appendix and acute Meckel's diverticulitis.

**Case 6**—An 18-year-old white man was admitted on 10 December 1946 with a 12-hour history of periumbilical pain localized in the right lower quadrant of the abdomen and nausea. There was a history of three previous episodes which subsided spontaneously. The physical examination revealed rigidity, tenderness, and rebound tenderness over McBurney's point and rectal tenderness high on the right side. The white blood cell count was 9,600 with 2 percent band forms.<sup>73</sup>

percent segmented forms, and 19 percent lymphocytes. A preoperative diagnosis of acute appendicitis was made. At operation a normal appendix was removed. Twenty-four inches proximal to the ileocecal valve an acutely inflamed Meckel's diverticulum, 4 inches in length and with a broad base equal to the lumen of the ileum, was found and excised. The pathologist's report revealed a normal appendix and a Meckel's diverticulum showing acute inflammatory changes.

### *Obstruction*

The attachment of the anomalous diverticulum to other structures has frequently resulted in the complication of intestinal obstruction and often with strangulation of the involved intestine.

**Case 7.**—A 28-year-old white man was admitted on 20 March 1946 with a 12-hour history of severe abdominal pain localized in the right lower quadrant of his abdomen. He had vomited once and was constipated. Physical examination revealed rigidity, tenderness, and rebound tenderness in the right lower quadrant. The rectal examination showed tenderness on the right side. The preoperative diagnosis was acute appendicitis. At operation a normal appendix was removed. About 20 inches from the ileocecal valve was a Meckel's diverticulum, the tip of which was adherent to the mesentery of the ileum. Through the loop thus formed had passed several segments of small bowel which had become twisted and obstructed. The obstruction was relieved by freeing the tip of the diverticulum. The diverticulum was resected. The pathologist's report showed aberrant gastric mucosa in the tip of the diverticulum.

**Case 8.**—A 23-year-old Negro was admitted on 5 July 1947 with a 15-hour history of periumbilical cramplike pain shifting to the right lower quadrant 6 hours after its onset. There was nausea, vomiting, and constipation. Physical examination revealed rigidity, tenderness, and rebound tenderness in the right lower quadrant of the abdomen with rectal tenderness on the right. The white blood cell count was 11,000 with a differential Schilling's shift to the left. The preoperative diagnosis was acute appendicitis. At operation a normal appendix was found and further exploration revealed a Meckel's diverticulum whose tip was adherent to the posterior peritoneum. A partially obstructed segment of small bowel was incarcerated in the internal hernia thus formed. The obstruction was relieved by freeing the tip of the diverticulum. At this point the patient's condition became very poor and resection of the diverticulum was deferred. The postoperative course was uneventful and the patient was discharged and returned in 3 months for elective excision of the diverticulum.

### *Intussusception*

Intussusception with a Meckel's diverticulum as the causative factor is more common in children than in adults. The following case report is interesting in that a careful evaluation of the patient's past history revealed numerous episodes of intussusception with spontaneous reduction.

**Case 9.**—A 30-year-old white man was admitted on 12 May 1946 with a 2-year history of episodes of abdominal pain, borborygmus, and diarrhea. The episodes were of 2 to 4 hours' duration with sudden onset and cessation. After prolonged study he was discharged from the Army with the diagnosis of psychosomatic gastrointestinal disease. Four previous admissions to this hospital revealed no pathologic explanation for these episodes. In a gastrointestinal series a normal gastrointestinal tract was reported. The present episode occurred 12

hours prior to admission with severe abdominal pain, distention, nausea, and vomiting. Because of his past experiences, the patient delayed seeking medical care. The physical examination revealed abdominal distention, tenderness, most noticeable in the lower right quadrant with rectal tenderness on the right and a tense mass (which was described as dilated bowel) on the right. Peristalsis was high-pitched and borborygmi. Roentgenograms of the abdomen revealed dilated small bowel with fluid levels. A diagnosis of intestinal obstruction was made and Miller-Abbott intubation was accomplished. The signs of obstruction increased and his white blood cell count suddenly rose from 13,500 to 26,000. At operation a mucocoele intussusception of the terminal ileum into the colon was found and a right hemicolectomy with a transverse ileocolostomy was performed. The postoperative course was uneventful. The pathologic specimen revealed a true Meckel's diverticulum which had intussuscepted into the colon. A follow up 2 years later showed the patient to be symptom-free.

Tumors have been reported in Meckel's diverticulum and are usually incidental findings. Those reported are carcinoma, carcinoid, leiomyoma, leiomyosarcoma, fibroma, sarcoma, and benign polyps.<sup>11-17</sup>

#### Foreign Bodies

Foreign bodies have been found in a Meckel's diverticulum causing inflammation and occasionally perforation. Calculi<sup>18</sup> and fish-bones<sup>12,11,13,15,19,20</sup> have both been reported.

#### Incarceration in Hernias

One of the original descriptions of an ileal diverticulum was made by Lettie, who found one incarcerated in a hernia. They have also been reported as occurring in femoral, ventral, inguinal, umbilical, and crural hernias.<sup>19,21-23</sup>

<sup>11</sup> COSTIEN, R. J. and McNAMARA, W. L. Carcinoma of Meckel's diverticulum: case report. Ann Surg 124: 505-517, Sept 1946.

<sup>12</sup> ALBRIGHT, H. I. and STRICKER, J. S. Primary adenocarcinoma in Meckel's diverticulum. New England J Med 226: 342-346, Jan 22, 1942.

<sup>13</sup> KURTZ, J. D. and BLACK, W. C. Perforated leiomyoma of Meckel's diverticulum: report of case. Surgery 10: 639-641, Oct 1941.

<sup>14</sup> SKINNER, E. C. and WALTERS, W. Leiomyosarcoma of Meckel's diverticulum with roentgenologic demonstration of diverticulum: report of case. Proc Staff Meet., Mayo Clin 14: 102-107, Feb 17, 1939.

<sup>15</sup> BROWN, J. H. Intussusception associated with polyp in Meckel's diverticulum: report of case. J. M. A. Geord 130: 786-791, Sept 1941.

<sup>16</sup> COLLINS, D. C., COLLINS, F. K., and ANDREWS, V. P. Ulcerating carcinoid tumor of Meckel's diverticulum: case report. Am J Surg 49: 434-461, Mar 1938.

<sup>17</sup> ALLEN, A. W. and DONALDSON, G. A. Meckel's diverticulum containing calculi. Arch Surg 59: 259-267, June 1945.

<sup>18</sup> WEINSTEIN, V. A. Fish bone perforation of Meckel's diverticulum. J. M. Siml Hosp 9: 29-32, May-June 1942.

<sup>19</sup> HUMPHREY, B. and LIPP, S. T. Left inguinal hernia with acute Meckel's diverticulitis and peritonitis: report of case. New England J Med 226: 15-16, Jan 1, 1942.

<sup>20</sup> TAVARES, J. M. Case of acute granulomatous diverticulitis (Meckel's) with perforation due to fish bone. Mil Surgeon 57: 724-729, Oct 1940.

<sup>21</sup> PATTERSON, F. M. S. Incarceration of Meckel's diverticulum in femoral hernia: report of case. North Carolina M. J. 7: 59-60, Feb 1946.

<sup>22</sup> STROMIL, E. H. and McAKRITHA, S. W. Incarcerated Meckel's diverticulum in femoral hernia. Arch Surg 38: 783-785, Apr 1939.

<sup>23</sup> KERRIG, J. L. Meckel's diverticulum in site of ventral incisional hernia: report of case. Wisconsin M. J. 36: 733, Sept. 1937.

### DIAGNOSIS

The preoperative diagnosis of this condition is rarely made. Gastrointestinal series have occasionally revealed the presence of a Meckel's diverticulum, but for the most part the diagnosis is invariably made at operation.

### TREATMENT

The treatment of Meckel's diverticulum with its complications is surgical, the extent of surgery being governed by the pathologic changes found. The diverticulum should be excised. If the base is broad, it may be divided longitudinally and closed transversely to the long axis of the bowel. If the base is narrow, simple purse-string inversion may be carried out without narrowing the lumen of the ileum.

### SUMMARY

Congenital Meckel's diverticulum is subject to various complications, and the treatment is surgical. Our series of nine cases over an 18-month period illustrates most of the complications encountered. It should be reemphasized that in all celiotomies a search should be made for this anomaly, and particularly should the search be made when the pathologic changes found in the appendix are not sufficient to account for the subjective and objective findings.





# Amebiasis and the Complement-fixation Test<sup>1</sup>

CHARLES I. CRAIG, Colonel, MC (Ret.), U. S. A.<sup>2</sup>

**I**N ORDER to understand what may be expected from the complement-fixation reaction in the diagnosis of amebiasis, one must have a clear conception of this infection. When I first became interested in the condition over 50 years ago, amebic dysentery was the name applied to all infections with *Endamoeba histolytica*. It was believed that this was a disease entity and that all infections were accompanied by a severe dysentery. At that time I was stationed at what is now the Letterman Army Hospital, San Francisco, Calif. Hundreds of our soldiers with amebic dysentery were seen at the hospital on their return from the Philippines. Amebic dysentery was one of the most important infections among our troops in those islands at that time. Unfortunately, the concept that amebic dysentery is a disease entity still lingers and few cases of infection with *E. histolytica* are reported to our boards of health unless the patient has dysentery. Actually, dysentery is but one of the symptoms caused by this parasite and the term "amebiasis" includes all infections with it. Such infections may be symptomless or accompanied by numerous symptoms connected with the intestinal tract or with invasion of the tissues of the body by the parasite.

*E. histolytica* has two principal life cycle stages: (a) a vegetative or trophozoite stage and (b) a cystic stage. In the former, it is actively motile, able to penetrate the tissues of the intestine or other parts of the body through the action of a cytolytic substance, or substances, and by its mobility. The trophozoite state, in which it multiplies by binary division, continues until conditions become unfavorable; then the parasite becomes motionless, spherical, and secretes a cyst wall. These cysts do not undergo full development within the

<sup>1</sup> Presented at the Fourth Army Area Medical Laboratory Seminar on 1 March 1950.

<sup>2</sup> Consultant, Fourth Army Area Medical Laboratory, Fort Sam Houston, Tex.

intestine but are passed in the feces and are the infective agents which, when ingested in contaminated food or drink, liberate eight young trophozoites in the intestinal tract, and the life cycle is repeated. *Cysts do not occur in any of the tissues invaded by this parasite but only in the lumen of the large intestine when conditions become unfavorable for the existence of the trophozoites.*

The pathologic changes produced by *E. histolytica* vary from microscopic excretions and areas of lysis, caused by the cytolytic substance secreted by the ameba, to extensive necrosis of the tissues and the formation of large ulcers extending to the peritoneal coat of the intestine or amebic abscess of the liver, lung, brain, or other organs, as well as lesions elsewhere in the body, including the skin. The great variation in the severity of the pathologic lesions caused by this parasite, and the variations in the response of the tissues to the infection, account for the apparent contradictions in the results of the complement-fixation test. Thus, one may get a four-plus reaction in patients showing slight symptoms, or no symptoms of the infection, although in a severe symptomatic infection the result of the test may be a weak or even a negative reaction. The severity of tissue invasion cannot be judged by the symptomatology, or lack of it, as it has been shown by several observers that severe lesions may be present in the intestine, even in symptomless infections. Thus, Bartlett,<sup>2</sup> in 1917, described the postmortem findings in 22 soldiers admitted to the hospital for other conditions. Eleven of them had never had diarrhea or dysentery, and were apparently asymptomatic carriers of *E. histolytica*. In all of the latter definite ulcers caused by this parasite were present in the large intestine, some of large size and penetrating to the muscular and peritoneal coats of the intestine. In such latent cases the complement-fixation test would, in all probability, give a positive result, as is the case in a large proportion of latent infections, although in some cases of severe amebic dysentery the reaction may be negative because of the inability of the body to produce complement-fixing bodies when the infection is very severe. There is no lasting immunity in amebiasis and a positive complement-fixation test disappears within 2 to 4 weeks following elimination of *E. histolytica*. Its persistence after this period, even though the parasite has disappeared from the stools, indicates that a focus of infection is still present in the body, perhaps in the liver, to be followed weeks or even months later by an amebic abscess of that organ.

The methods that are available for the diagnosis of amebiasis include the microscopic examination of unstained and stained preparations of

<sup>2</sup> BARTLETT G. B. Pathology of dysentery in the Mediterranean Expeditionary Force 1915. Quart. J. M. & H. 185: 284 Apr 1917.

the stools, using concentration methods, the use of the sigmoidoscope, the cultivation of *E. histolytica* in suitable culture media, and the complement-fixation test. In all suspected cases the stools should be examined for the ameba and if sufficient time be expended and the examiner is trained in the differentiation of *E. histolytica* from the four other species of amebas occurring in the intestine of man, generally accepted as nonpathogenic, and if the examination is repeated several times when the first one is found negative, the parasite will be found if present. This often means the expenditure of much time and money. Sigmoidoscopic examination should be made if the stools are negative but about one-third of the infections may be missed if this method of examination is used alone, especially if there are few or no symptoms, because about one-third of the lesions occur only in the ileocecal and upper portion of the large intestine. Cultivation of *E. histolytica* from the stools should also be attempted routinely and some authorities believe this method of diagnosis is more useful than the microscopic examination of the stools.

Complement fixation is, at present, merely an aid in the diagnosis of amebiasis and should not be attempted until the diagnostic methods previously mentioned have been employed. If we possessed a complement-fixation test that always gave positive results in all infections with *E. histolytica*, and never in other disease conditions, it could be used as a routine diagnostic test to the exclusion of other methods of diagnosis; but unfortunately the complement-fixation test for amebiasis is not perfected at present and does not always give positive results in all infections with this parasite and negative results in all other infections and disease conditions. As with most complement-fixation tests, false positive and false negative results may be obtained.

At present the antigens employed in the test are not made from pure cultures of *E. histolytica* and are always contaminated by bacteria. It has been repeatedly demonstrated that such contamination does not cause false reactions and that complement fixation in amebiasis is a specific reaction; that a positive reaction disappears within a comparatively short time, usually 2 to 4 weeks after the elimination of *E. histolytica* by treatment; that a positive reaction is obtained with antigens made from washed cysts of the parasite; and that positive reactions are obtained with the blood serum of animals immunized to the ameba and from whose blood serum antibodies against the accompanying bacteria in the inoculum employed in immunizing the animals have been removed.\*

\* SUTWOOD, N. P. and HEATHMAN, L. Further studies on antigenic properties of pathogenic and free living amebas; complement fixation in amebic dysentery. Am J Hyg 51: 121-136 July 1952

Employing the technic I have recommended for the test, from 85 to 90 percent of positive results were obtained in symptomatic amebiasis and from 70 to 80 percent in asymptomatic or latent infections. False positive reactions were obtained in some cases of chronic ulcerative colitis but few such reactions have been reported in other diseases. The results obtained with the test by other observers have varied greatly, probably because of variations in technic and the strength of the antigens used. It is a natural inclination, on the part of laboratory workers, to devise individual technics and this has been notably true of the complement-fixation test for amebiasis; hence it is not surprising that variations in the results obtained with this test have been reported by those who have modified my original technic. Refinements have been made in the technic that were unnecessary and that have led to confusion and a smaller percent of positive results, especially in symptomless infections with *E. histolytica*. Unlike generalized infections, infection with this parasite is usually localized in the tissues of the large intestine and apparently the production of antibodies is much lower and the complement-fixing antibody is present in small amounts, thus making it more difficult to demonstrate its presence by a complement-fixation test. This fact probably explains the negative results obtained in a large proportion of infections with *E. histolytica* by some of the modified technics employed by certain investigators. In other words, too much refinement in technics has injured the value of the test as a diagnostic agent in amebiasis.

When a positive reaction is obtained in a suspect, it is justifiable to regard it as strong presumptive evidence that infection with *E. histolytica* is present and treatment should be administered. A negative reaction does not prove that such an infection is absent although such a reaction in conjunction with negative results with the other diagnostic tests mentioned would be conclusive. The permanent disappearance of a positive reaction after treatment and negative stool or other examinations definitely indicates that the parasite has been eliminated and treatment has been successful.

While, as stated, this test cannot, and should not, replace the other methods of diagnosis available in amebiasis, the complement-fixation test possesses a definite value in the diagnosis of this infection. It is most valuable in those infections in which, for any reason, it is impossible to make proper examinations of the stools, but it is also valuable under other conditions. The complement-fixation test has definite practical value in (a) the discovery of carriers or cyst-passers (when used as a routine diagnostic procedure), (b) the diagnosis of amebic liver abscess, (c) the diagnosis of acute and chronic amebic dysentery, (d) the control of the treatment of amebiasis and the

evaluation of drugs used in such treatment, and to test the efficiency of proposed amebicidal drugs in animals. It is employed whenever possible but never to the exclusion of examinations and cultivation of the ameba.

*The discovery of carriers or cyst-passers.*—In many hospitals stool examinations are not made, but blood examinations and the Widal test are made on every patient. The complement-fixation test for amebiasis could be made at the same time and such a procedure has resulted in picking up many latent amebic infections in carriers or cyst-passers. This procedure was used at the Army Medical School in Washington while I was stationed there and resulted in the discovery of amebiasis in many asymptomatic persons whose stools would not routinely have been examined. Subsequent examination of the stools of these persons almost invariably resulted in the demonstration of *E. histolytica*, and thus proved the value of the test in the discovery of latent amebic infections.

*The diagnosis of amebic abscess of the liver.*—The complement-fixation test usually gives a strong positive reaction in amebic hepatitis and amebic abscess of the liver, and when it is impossible to make stool examinations, or when the stools are negative for *E. histolytica*, it is of great practical value. Not infrequently an amebic abscess of the liver develops after the elimination of the intestinal infection and in such cases a positive complement-fixation reaction is absolutely diagnostic, and should always indicate proper therapeutic or surgical treatment of the patient giving such a reaction and in whom there are suspicious symptoms of hepatitis or abscess formation.

*The diagnosis of acute and chronic amebic dysentery.*—When, for any reason, it is impossible to examine properly the stool for *E. histolytica*, the complement-fixation test is of practical value in differentiating acute or chronic amebic dysentery from other forms of dysentery. In the majority of patients with dysentery caused by this parasite, the complement-fixation test gives a positive reaction, and when stool examinations cannot be made, this test should be of great value in diagnosis.

*The control of the treatment of amebiasis and the evaluation of the drugs used in treatment.*—A positive complement-fixation reaction usually becomes negative within from 2 to 4 weeks after the elimination of *E. histolytica* by treatment. If it does not become negative, even though the ameba has disappeared from the stools, one may be practically sure that the infection still persists somewhere in the tissues, and this will be proved by the reappearance of the parasite in the stools. In such patients treatment should be repeated and continued until the reaction becomes permanently negative. If used in this manner, the complement-fixation test for amebiasis is of practical

value in controlling treatment and in evaluating the amebicidal properties of the drugs used in the treatment of amebiasis.

*The testing of amebicidal compounds.*—The complement-fixation test may also be used in testing the efficiency of new compounds proposed for the treatment of amebiasis, as animals susceptible to infection with *E. histolytica* can be employed for this purpose and the value of the drug proposed for treatment can be ascertained by its effect on the complement-fixation reaction. We have shown that this is true. By experiments on dogs and the use of the complement-fixation test, it was found that the recommended dose of a well-known commercial compound, used in the treatment for amebiasis, had to be increased at least six times to eliminate the amebic infection in the animals.

This test should never be used to the exclusion of stool examinations and cultivation of *E. histolytica* and it should be limited to laboratories in which well-trained personnel is available. At present the technical difficulties connected with the test, especially the difficulty in securing efficient antigens, precludes its general use, but improvements in this direction will undoubtedly be made and it will become a much more useful diagnostic procedure.



# Medical Service Field Research Laboratory

RAY G. DAGOS, Ph.D.<sup>1</sup>

FREDERICK J. KNOBLAUCH, Colonel, MC, U. S. A.<sup>2</sup>

THE Armored Medical Research Laboratory was established at Fort Knox, Ky., 1 September 1942 through the continued efforts of the Surgeon General, U. S. Army, the Surgeon of the Armored Forces, and the Committee on Industrial Hygiene of the National Research Council. The mission of the Laboratory at that time was to study additional physical and mental stresses placed on the soldier in the operation of armored vehicles with a view to improving his comfort and providing additional safety measures to protect him in the performance of his military tasks. Soon after the establishment of the Laboratory it became evident that such a research organization could well serve the entire Army by providing information relative to individual stresses and tolerances of soldiers participating in various military tasks in addition to the operation of armored vehicles. Its mission, therefore, was broadened.

During the war the Laboratory operated under the direct supervision of the Army Ground Forces. At the end of the war the Laboratory was placed under the direct control of the Surgeon General, U. S. Army. The Laboratory was then reorganized and shortly thereafter renamed the Medical Department Field Research Laboratory. The reorganization was based on long-range planning, and civilian scientists were engaged to head all phases of the research activity. Its mission was again broadened with more emphasis being placed on basic physiologic research.

The present mission of the Laboratory is to provide, through research, scientific information on physiologic and closely related problems that may have military significance. Particular emphasis is placed on problems of environment and reaction to stress. Although

<sup>1</sup>Director of Research, Medical Service Field Research Laboratory, Fort Knox, Ky.

<sup>2</sup>Commanding officer, Medical Service Field Research Laboratory, Fort Knox, Ky.



# The British Army Divisional Medical Organization

R. D. CAMERON, Major General, R.A.M.C.<sup>1</sup>

THE medical organization within the division consists of (a) 1 Assistant Director of Medical Services (ADMS)<sup>2</sup> and his staff (b) Field Ambulances,<sup>3</sup> three in an infantry or airborne division and two in an armored division; (c) one field dressing station (FDS) per armored or infantry division, also allocated to an airborne division in a ground role; and (d) regimental medical establishments

## ASSISTANT DIRECTOR OF MEDICAL SERVICES

The ADMS, a colonel, is the advisor to the divisional commander on all matters which affect the health of the troops, and this includes advice on health discipline and the prevention of disease. He commands the medical units in the division and is responsible for formulating the medical plan for the collection and disposal of casualties. He is attached to the Adjutant General's branch of the staff and is located at main divisional headquarters. He has 2 medical officers on his staff: A Deputy Assistant Director of Medical Services (DADMS) and a Deputy Assistant Director of Army Health (DADAH). In addition there are 15 noncommissioned officers of the medical corps: 6 clerks, 1 orderly, and 8 sanitary assistants.

## THE FIELD AMBULANCE

All Field Ambulances are standard and are similar in personnel. Field Ambulances with airborne divisions, in view of their special

<sup>1</sup> Inspector of Training of the British Army Medical Services at the time of writing this article and now Director of Medical Services (Theatre Surgeon), The British Army on the Rhine.

<sup>2</sup> Corresponds to our division surgeon

<sup>3</sup> Corresponds to our old collecting company or a combination of the collecting section of a regimental medical company and a section of an ambulance company under our new T.O.

employment, have different types and scales of equipment and a minor difference in transport. A Field Ambulance consists of an HQ, and HQ section, and one company, which is divisible into a small company HQ and three equal sections similar in every way to the HQ section. The sections form casualty clearing posts (CCP)<sup>4</sup> for the evacuation of regimental aid posts (RAP)<sup>5</sup> and are administered by the company HQ. The HQ of the Field Ambulance holds the bulk of the equipment and forms the advanced dressing station (ADS).<sup>6</sup> The Headquarters section assists the ADS or is used for leapfrogging, augmenting, or relieving the company as required. The organization of the unit permits great flexibility.

The primary role of the Field Ambulance is the rapid collection of sick and wounded, the rendering of first aid to casualties, their preparation and classification for further disposal, and the completion of necessary documentation. It is a mobile unit and is not equipped to provide other than the simplest accommodation and essential treatment. When not engaged in active operations the Field Ambulance may hold patients with minor illnesses. This is a secondary role and cannot be undertaken in combat when casualties must be evacuated as soon as they are fit to travel. The Field Ambulances of airborne formations are specially trained and equipped for their special duties. When taking part in an airborne operation each Field Ambulance has two field surgical teams attached to enable the unit to operate independently when it is out of contact with ground forces. As soon as a link-up with the ground forces is made, the normal casualty evacuation procedure is reverted to.

Field Ambulances are divisional troops, and as such their disposition is controlled by the ADMS acting under authority of the divisional commander. One Field Ambulance is usually allotted in support of each infantry brigade<sup>7</sup> and then becomes an element of the brigade group, in which case it conforms to the movements of the brigade, and collects the casualties occurring on the brigade front. The sitting, opening, and closing of the ADS's is controlled by the ADMS, except in the initial stages of a planned battle when he frequently delegates his authority to the Field Ambulance commander, in which case the latter will inform the ADMS in advance of any intention to move and at once report the location to the ADMS. In

<sup>4</sup> Corresponds to our collecting post or point

<sup>5</sup> Corresponds to our battalion aid stations

<sup>6</sup> An intermediate unit corresponding to a combination of part of our collecting and clearing stations

<sup>7</sup> Corresponds to our regimental combat team

certain operations the Field Ambulance is placed under the commander, e. g., when the brigade is acting independently, early stages of an airborne operation. In this event the Field Ambulance commander, with the concurrence of the brigade commander, will locate and open the ADS. He should, if possible, intimation to the ADMS and invariably report its location. An ADS may be opened for each brigade in action, or the ADMS may be limited to open one, or possibly two, for the divisional front.

The Field Ambulance commander attends brigade operational conferences and maintains contact with brigade headquarters throughout operations in order to obtain up-to-date information which will enable him to arrange for the speedy evacuation of casualties. The Field Ambulance commander is the senior medical officer of the brigade, and as such is the advisor to the brigade commander in medical matters. He should frequently visit all units in the brigade area.

The guiding principles in the evacuation of casualties within the division are: (a) the maximum speed consistent with efficiency, limiting treatment to controlling shock and hemorrhage, relieving pain, and rendering the patient fit for evacuation; and (b) minimal handling of the patient such as transfers between ambulances and change of dressings.

*Field Ambulance section.*—The role of a Field Ambulance section is to collect casualties from RAP's and evacuate them without delay to the ADS. It can perform this function either by: (a) direct transportation of casualties from RAP to ADS, (b) establishing an ambulance post at an intermediate point, or (c) establishing a casualty collecting post (CCP).<sup>\*</sup> It is often convenient to use two or more sections together thus forming a combined CCP. Prior to an engagement it is usual to attach one or more stretcher-bearer squads from the section to the RAP. If the ground permits, one jeep or ambulance is also attached. Treatment in a CCP should be confined to such first-aid measures as the regimental medical officer (RMO) may have been unable to carry out, and first aid for cases which have not passed through an RAP. It is primarily a check point, and it is only necessary to ensure that hemorrhage is under control and that fractures and large flesh wounds are immobilized. Dressings and splints should not be removed unless such a procedure is essential before further evacuation. Hot sweet tea should be available. When there is an extended line of evacuation there may be occasions when it is necessary to assign to the CCP its additional role of a treatment center. These occasions should be rare. The main object is to transport casualties to the ADS as quickly as possible.

\* Corresponds to our collecting post or point.

*Field Ambulance company headquarters.*—The role of the company headquarters is to control, administer, and maintain the three company sections. In addition, the company commander controls and coordinates forward evacuation from RAP's and locates CCP's under the Field Ambulance commander's direction. The company commander frequently visits RMO's and maintains contact with the brigade headquarters staff. The company headquarters is located where it can best control evacuation from the brigade group. This is normally at the junction of the lines of evacuation from which all sections are operating. It is not intended to form a medical post but a small amount of medical equipment is carried for the treatment of local casualties and sick.

*Field Ambulance headquarters.*—The HQ of a Field Ambulance forms the ADS. It generally operates under the control of the ADMS division, but may occasionally be placed under the control of the brigade commander. In the former case, it will usually be possible for the ADMS to select the site of the ADS only at the commencement of an engagement, particularly in mobile warfare. It will usually be the task of the Field Ambulance commander to select any subsequent site and report this to the ADMS and the Brigade commander or commanders concerned. When the ADS serves more than one long mile, the ADMS controls its movements and issues orders to the Field Ambulance commander accordingly giving the approximate area in which to open, and the time for opening. When the unit is under the control of a brigade commander, the Field Ambulance commander normally selects the site of the ADS in conjunction with the brigade staff.

*Advanced dressing station.*—The role of the ADS is to receive casualties from one or more brigade fronts, through the CCP's, or directly, and to provide essential treatment in order to render the casualties fit for evacuation as soon as possible. Speed in passing wounded through the ADS is essential. The ADS is the main medical center in the brigade or divisional area and is formed by the HQ of a Field Ambulance. It is equipped to provide only such surgical treatment as is essential to render casualties fit to travel to the casualty clearing station (CCS)\* where major surgical facilities are available. The ADS is equipped with shelters and tents for the accommodation of casualties. It can accommodate 150 patients. It may be wholly under canvas, but the use of buildings when suitable and available is a great advantage.

An ADS would be located on, or adjacent to, good roads and requires:

\* Corresponds to the patient holding element of one dressing company.

- (a) An adequate in- and out-circuit for ambulances.
- (b) Accommodation (preferably in buildings) for casualty into reception, treatment, and evacuation zones. For the evacuation to a CCS, walking patients are classified as patients before they can be evacuated. When possible, the accommodation should be allotted to litter and sitting patients.
- (c) Facilities for treatment and documentation.
- (d) Water supply, cookhouse for patients and personnel, latrine and mortuary (gas protection may have to be provided).
- (e) Pack stores for equipment and arms.
- (f) Reserve of splints, dressings, blankets, and stretchers.
- (g) Accommodation for personnel.
- (h) Natural protection against shelling and bombing. When time permits and particularly in position warfare, an ADS should be able to withstand direct hits from small projectiles, and slit-trench protection should be provided. The location of the ADS and all medical posts must be clearly shown by day and night signs. All road junctions in the neighborhood in all directions must be adequately signposted. All signposts must be removed on change of location. Specifically detailed NCO's will carry out signposting as a drill. The staff of an established ADS should be divided into teams so that rest periods can be arranged and additional staff are easily available to augment the ADS when required. The personnel of HQ section, when with the ADS should be incorporated in the teams.

Special care must be taken of the personal effects of casualties immediately on admission. This is the duty of the NCO in charge of the pack store, who will collect, list, pack, label, and seal these articles. Particular attention must be given to money, valuables, rings, watches, and any articles of sentimental value. Similar care must be taken of the personal effects of the dead. These effects are specially labeled and sent to the second echelon.

The detailed tasks of the ADS are:

- (a) Treatment of the casualty: Wet and soiled clothing is removed and the patients are clad in pajamas. They are made as comfortable as possible and kept warm and dry. Hot sweet tea and a hot meal are given to all, except when medical reasons prohibit this. All previous treatment is checked and any omissions rectified. Tourniquets if previously applied are removed. If hemorrhage persists, other methods are adopted for its control, viz., ligature of the artery or the application of pressure forceps, failing which, the tourniquet is reapplied. Sucking chest wounds are closed by temporary means. If a limb is so shattered that it can be severed by a pair of scissors, it is removed to avoid continuance of shock. Pain is controlled by injection of mor-

phine; sedation of exhausted patients is undertaken. Shock is combated by the afore-mentioned methods and the use of plasma. As a rule it is better to avoid transfusion with whole blood at the ADS. If, however, the chances of survival are doubtful without blood transfusion it should be begun and continued as a drip in the ambulance on the journey to the CCS. The time and place for a blood transfusion is normally at the CCS prior to an operation. Every casualty to whom morphine has been administered is marked on the forehead with the letter "M" in grease pencil. Similarly the letter "T" is used when a tourniquet is employed.

(b) Documentation of the casualty: An accurate regimental and clinical record of casualties is a definite responsibility of all medical units through which casualties pass. This record consists of the number, rank name, unit, and diagnosis of the casualty. It is required so that the next-of-kin can be informed of the casualty as soon as possible. General headquarters personnel, second echelon, are charged with this duty, and to carry it out they depend on the nominal rolls of casualties received from medical units. These rolls are an extract from the admission and discharge book kept by all medical units in the force. A record of the clinical condition and treatment of casualties in their progress through medical units is necessary so that each succeeding medical unit can adopt the optimum treatment of the casualty in the line of evacuation where a permanent record of the casualty can be undertaken in the ADS formed by the headquarters of the Field Ambulance. Documentation must not delay treatment or evaluation of the casualty.

(c) Classification of the casualty. The wounded are placed in one of three priorities according to their clinical condition. Priority 1 includes patients requiring resuscitation and/or urgent operations; e.g., penetrating abdominal wounds, open chest wounds, compound fractures of the femur, extensive lacerated muscle wounds, and severe shock. Priority 2 includes patients requiring early operation and possibly resuscitation, e.g., severe and multiple wounds, compound fractures and brain injuries. Priority 3 includes all other wounded. In general there will be sitting patients. Priority 1 and 2 casualties amount to 15 or 20 percent of the total.

(d) Evacuation of the casualty. Priority 1 and 2 casualties are evacuated to the CCS (or to the advanced surgical center if formed). Priority 3 casualties are also evacuated to the CCS except those whose injuries are so trivial that they will be fit to return to duty in a few days. They are sent to the divisional FDS. Patients with severe illness arriving at the ADS are evacuated to the CCS and patients with minor illness including exhaustion are transferred to the divi-

sional FDS. Patients transferred to the divisional FDS by ambulances of the Field Ambulance. All other patients are transported by ambulance and troop-carrying vehicles of the ambulance company under arrangements made by the Deputy Director of Medical Service, Corps.<sup>10</sup>

#### FIELD DRESSING STATION

An FDS consists of a small administrative headquarters and equal sections which can operate away from the unit HQ but maintained by the HQ. The sections may operate together separately, or be used for leapfrogging. An FDS is designed to treat 100 patients, 40 on beds and the remainder on stretchers. The primary role of the divisional FDS is to maintain the fighting strength of the division within the division by holding all minor sick, injured, and mildly exhausted patients. Normally only patients who are expected to be fit for return to duty in 7 days are held. This period may be altered according to the local or general situation. In special circumstances the FDS may be employed in the divisional evacuation plan. The FDS is sited by the ADMS in consultation with the divisional staff and is normally in the rear divisional area and away from gun positions. The FDS possesses shelters and tents, but should be in buildings if suitable and available. Adequate bathing, reading, and other amenities should be provided whenever possible. Evacuation from the FDS to the CCS is by ambulances of the motor ambulance company, and is the responsibility of the Deputy Director of Medical Service, Corps.

Intercommunication between RMO's, sections, and Field Ambulance HQ is normally by dispatch rider or returning ambulance. Between ADMS and medical units it is by dispatch rider, telephone, or radio. Brigade headquarters may also arrange to link up the affiliated Field Ambulance by radio.

#### REGIMENTAL MEDICAL ESTABLISHMENTS

In war, each battalion and similar units have a medical establishment consisting of one medical officer and one to six NCO's, according to the unit. One NCO is provided by the unit as the regimental medical officer's orderly. Regimental personnel are detailed as regimental stretcher bearers and are placed under the orders of the RMO. They are distinguished by a stretcher bearer's armband lettered "SB" worn on the left arm. In addition, personnel of the unit are specially trained in water and sanitary duties. A number of smaller units do not carry a medical officer on their establishment but on active service have personnel trained in water and sanitary duties and first aid. In

<sup>10</sup> Corresponds to our Corps Surgeon.

such cases, a medical officer of a nearby unit is appointed as officer in medical charge, in addition to his other duties.

*Regimental medical officer.*—The officer in medical charge of a unit is directly under the control of the administrative medical officer of his formation in professional matters but in other respects he is under the orders of the unit commander. The regimental aid post should normally be in close proximity to the centrally placed unit headquarters to permit access to and from all parts of the unit front. The RAP should afford protection from rifle fire and machine-gun fire and mortar splinters. The exact site must depend on the tactical situation. If possible, the RAP should be accessible to the ambulances of the Field Ambulance. Unit RAP's should not be amalgamated.

In action, the RMO should locate himself at his RAP. It is rarely possible and indeed it is undesirable for him to proceed further forward, since when he is separated from his medical equipment he can do little more than a trained stretcher bearer. Meanwhile, casualties requiring his expert aid would be accumulating in the RAP. During the battle an RMO can only carry out the essentials of first aid. This includes the control of hemorrhage, the immobilization of fractures and gaping flesh wounds by splints, the commencement of prophylactic treatment with sulfonamides or antibiotics, the applications of dressings, and the administration of morphine. Close liaison between the RMO and the Field Ambulance is essential. Although the RMO should inform the supporting section of any change of location of the RAP, it is the responsibility of the Field Ambulance commander to maintain touch with the RAP by means of his company and section commanders.

# Female Staffing Program in . . . Army Hospital

JOHN T. GRAY, *Captain, MSC, U. S. A.*<sup>1</sup>

THE Army Medical Service has been conducting an experiment in military hospital staffing since 1 June 1949. This staffing experiment was conducted at Murphy General Hospital, Waltham, Mass., until 30 April 1950 when the program was transferred to the U. S. Army Hospital, Fort Devens, Mass., because of the closure of the general hospital.

The idea for the female staffing program originated from experience gained in World War II and from the realization that in the event of another war, mobilization of national resources, including personnel, would most likely be on a greater scale than ever experienced by the United States in the past. Toward the close of World War II it became increasingly difficult to obtain male replacements in Army hospitals in the Zone of the Interior. This situation resulted in a progressively greater use of women in sub- or non-professional fields by the Army Medical Service. This utilization, however, was limited to assignments such as clerk, stenographer, chauffeur, and medical, surgical, and laboratory technicians. Their performance of duty was of such a high standard that it was deemed appropriate by the Surgeon General and the Director, Women's Army Corps to consider the possibility of maximum use of this source of labor in the event of an emergency. Before such a source could be fully exploited it was necessary to determine the extent to which an Army hospital could be staffed by female civilian and military personnel without deterioration in the standards of patient care and treatment. Other aims of the program are to develop female personnel requirements, formulate descriptions of those positions found suitable for occupancy by women, develop a training program which would train women as effective and qualified persons for hospital positions in the shortest possible time, determine the type of women which should be recruited for the staffing of Army hospitals, and to give the Medical Service experience, data, and plans for the use of women immediately available.

Murphy General Hospital was chosen as the site of the program because it was representative of all the activities found in an Army

<sup>1</sup> Medical Plans and Operations Division, Office of the Surgeon General, U. S. Army

hospital and the personnel demands and requirements were closely in line with the personnel availabilities. The Women's Army Corps personnel allocations to the program were, because of the size of the Women's Army Corps, very limited; and had the test been assigned to a larger Army medical installation it would necessarily have had to be limited to certain activities because of the nonavailability of personnel. Further, it was possible through the selection of this hospital as a testing site, to extend the testing program to the U. S. Army Hospital, Fort Devens, Mass., because of the Area Medical Service Plan in effect in that area. Thus, the program covered not only an Army general hospital but a station hospital as well. During the period of the testing program at Murphy General Hospital, 715 beds for the care of general medical and general and orthopedic surgical patients were in use. The patient census during the period of the test at this hospital averaged 67 percent of the authorized beds.

Female military personnel were assigned to Murphy General Hospital as they became available by transfer from other stations or through training installation activities. Male military personnel were transferred from the installation as soon as the female replacements became proficient in their assigned duties. Because of Civil Service restrictions and regulations, male civilian personnel were not replaced but emphasis was placed on the recruitment of civilian women when civilian positions were being refilled. The high point in female assignments was reached in December 1949 when a total of 440 women were participating in the program. For the purposes of the program, the positions in the hospital were divided into those pertaining specifically to its functions as a hospital and those pertaining to its operation as a military post. Of the 301 types of jobs considered at Murphy General Hospital, 210 were in the class of hospital type of activity while the remaining 91 pertained to its operation as a military post.

Operation of the program for 11 months determined that of the 301 types of positions only 54 (24 hospital-type and 30 post-type activities) could not be filled successfully by women because (a) the rough and laborious demands of the work to be performed were an important consideration, (b) disciplinary or command jurisdiction over male personnel appeared to call for the ruling hand of a man or a man was required by directive and custom, (c) of duty at isolated or lonely locations, especially at night, or (d) the modesty of the average woman and the sense of delicacy of male patients would make the services of a man desirable.

Decisions as to whether women were qualified to perform satisfactorily the duties of the various positions were reached only after

individual and careful consideration of each position. In all positions actually tested, decisions were reached after consideration of reports from supervisors under whom the job was performed, supplemented by inspections and observations. If, after testing, there was doubt as to the suitability of the position for a woman, a board of officers made the decision. If there was no opportunity to test a position by reason of nonavailability of time or personnel, decisions were influenced by the knowledge that the same or a similar position had been successfully occupied by women elsewhere under comparable conditions. A job analysis was sometimes a deciding element when a position could not be tested and more positive evidence was lacking. Suitability of women in all the positions was estimated on the basis of attributes, traits, and capabilities common to the average, not the exceptional, woman. The usual degree of physical strength and sense of modesty was assumed to prevail in all instances.

A review of the available data concerning the female testing program indicates that 84 percent of the positions in a hospital comparable to Murphy General Hospital might be successfully filled by women. The female staffing of the hospital type of activity could be 92 percent female while that of the post type of activity could be 60 percent. These female staffing percentages can be considered sound and practical only when fully trained and qualified female personnel are available. The availability of qualified women will most likely depend on other military and civilian requirements, the location of the hospital, the activity of training installations, and the standards for female personnel recruitment.

The major problem which developed and was prevalent throughout the period of the testing program was that of training. It quickly became apparent that the preponderance of the positions in the hospital could be filled by women who were adequately oriented and trained. While female supervisors were hand-picked at the commencement of the female testing program in order to give it momentum, other women were obtained through normal personnel procurement channels in order to provide more realism and to create a true testing situation. Personnel training was accomplished mainly by "on-the-job" instruction and supervision backed up by periodic formal training. As the women became proficient in their administrative and technical duties, men were released for assignments to other stations. Although this method of training created an over-strength in some areas of the hospital staff, this over-strength was considered necessary in the interest of patient care during the training period.

The housing and welfare of the female personnel were carefully considered. These requirements are somewhat greater for women

- (a) Registration up to the fiftieth birthday.
- (b) Induction up to the fifty-first birthday.
- (c) Priorities for call substantially as follows:

1. Those who participated as students in the Army Specialized Training Program or similar programs administered by the Navy, and those who were deferred from service during World War II for the purpose of pursuing a course of instruction leading to education in medical, dental, or allied specialist categories, who have had less than 90 days of active duty in any of the Armed Forces or the Public Health Service subsequent to the completion of or release from the program or course of instruction (exclusive of time spent in postgraduate training).

2. The same group who have had 90 days or more but less than 21 months of active duty.

3. Those in the professions who have had no service in the Armed Forces or Public Health Service subsequent to 16 September 1940.

4. Those in the professions who did have service since 16 September 1940, and, in general, may be called to duty in inverse ratio to the length of their active service subsequent to 16 September 1940.

(d) Such rules and regulations as the President may prescribe, to permit the deferment of.

1. Persons in the national interest, for reasons of hardship or dependency, or in the maintenance of the national health, safety, or interest.

2. Preprofessional students for continuation in training.

(e) The establishment of a National Advisory Committee to the Selective Service System and the coordination by the Committee of the work of State and local volunteer advisory committees.

(f) Additional pay of \$100 per month for medical and dental officers "of the Reserve components called or ordered to active duty with or without their consent, if otherwise qualified, \* \* \*," but "no person inducted (i. e., as an enlisted man) under the provisions of this Act shall be entitled to (these) benefits \* \* \*."

(g) Transfer between the Armed Services of officers holding commissions in the Medical Service or Corps is authorized with.

1. The officer's consent.

2. The consent of the service from which the transfer is to be made.

3. The consent of the service to which the transfer is to be made.

The Act further states that "no officer upon transfer to any service from which previously transferred shall be given a higher grade or place on applicable promotion list, than that which he would have attained had he remained continuously in the service to which retransferred."

It is not possible at this writing to comment exhaustively on the potential ramifications of this bill. Some of the problems are foreseeable and these present a challenge to the Armed Forces, to the administration of the Selective Service System, and to the civilian professions in their functions as national and local advisors. Some of these problems which are now receiving the attention of the services are:

(a) Classification of professional qualifications. A method whereby members of the professions registered under this act can be classified as to specialty and as to proficiency within the specialty is prerequisite to proper use by the Armed Forces. Complete ground work was accomplished by the Army in the late years of the last war and in the postwar period which should make this task much easier.

(b) Commissioning in the Reserve components. Since those who do not have Reserve commissions are subject to induction as enlisted men and therefore would not be entitled to the additional pay of \$100 per month, it can be expected that every thinking man in the first, second, and third priorities will early seek Reserve commissions. In order to assure equitable distribution among the three services of these specialists, it would seem to be necessary that commissioning quotas be established which could be raised from time to time as the total is reached by the services.

(c) Call to active duty. If a large number of the registrants covered by this act apply for and obtain commissions in the Reserve components, it is conceivable that the Selective Service System and its advisory bodies will be involved only in registration and classification and that the call to active duty will be made by the Armed Forces in accordance with established procedures for calling Reserve officers to duty. On the other hand, if only a few apply for and obtain Reserve commissions, the Selective Service System may bring the large majority to duty through induction procedures. It is possible that both call to duty by the Armed Forces and induction by the Selective Service System will be required to function concurrently.

(d) Transfers between Armed Forces. On 26 July 1950 authority for transfer between Army and Air Force terminated. Authority for transfer between the Armed Forces has heretofore never included the Navy. With the reinstitution of authority for inter-service transfers, the problem of preventing promotion advantage from accruing

to any retransferee (as prescribed in the Act) probably presents the greatest administrative problem.

(e) Integration of calls of Reserve officers involuntarily or with units within the spirit and intent of the Act. It has been necessary to bring a number of Reserve officers to duty with units and a few will have to be called to duty involuntarily before the Act can be implemented. Some of the officers will have had long service in the last war. There is much logic on the side of retention in the service of the officer who has consented to assignment with an organized Reserve unit because he has been drawing pay and gaining points toward an ultimate retirement carrying monetary value. Steps have been taken, however, to bring on duty as few officers with World War II service as is consistent with military necessity. Nevertheless, the intent of the special act for physicians and dentists and allied specialists is that those who have had World War II service should be required to serve last; thus, some sort of comparatively early separation criteria may be required.

In considering this new legal development, it is appropriate that those in the first priority of the bill should be called for service first because they were sent to professional school by the Army or Navy during the past war in order to assure that adequate numbers of doctors of medicine, dentistry, and veterinary medicine for the Armed Forces and the nation would be available. Thus, they were trained with the understanding that they would render service as might be necessary in their professions to further the war effort. When hostilities ceased, however, those in authority believed that they would not be needed within a reasonable time and they were forthwith released from obligation to service with the Armed Forces.

Now that authority exists to call these persons to active duty, it should be understood that they are the same as other members of their professions. They are patriotic. They desire to render service to the full extent of their capacities. They do not desire to be misassigned. They want to do professional work within the field for which they have been trained. They are individualists. They have pride in their profession and feel that it and they, as members thereof, should be respected by all. They have difficulty in adjusting to teamwork which includes the fundamental concepts of command and authority outside the professions. They are willing and glad to give service now that they know their compatriots will also be required to do so. All of this is understandable to any thinking person.

Improved career management policies of the Department of the Army have been developed over the past few years and are designed to insure full use of all officers. If properly executed, these policies

will be thoroughly satisfactory to both the service and the concerned. Commanders of all echelons will do well to look at career management programs over which they have control.

In summary, the first priority professional man with whom to work for the next few years is an enthusiastic physician seeking mental stimulation and unlimited work in his chosen field. He must be considered in this light, helped to develop, and encouraged to fit into his new environment with the enthusiasm which he naturally possesses.

## II. Medical Service in action

PAUL I. ROBINSON, *Brigadier General, MC, U. S. A.*

THE Far Eastern situation has given all of us an opportunity to view objectively the Service of which we are a part. Particularly has it given the Personnel Division an opportunity to adjudge the work of the past 3 years. Career planning, procurement programs, and training programs, all have been combined in the production and excellence of the Army Medical Service.

On 27 July 1950, the one hundred and seventy-fifth anniversary of the founding of the Army Medical Service, the Army Medical Service was engaged, as on the day of its founding, in the care of United States soldiers in combat, but never before has it gone forth so quickly—and never before has it been so well qualified to perform its task.

Within days after the fighting in Korea started, requisition for a large number of medical officers was received. We were able, by the end of July, to make available to the Far East Command their requirements by specialty qualification. Many of those who were sent to the Far East had to be taken from the residency program, but the spirit with which these officers proceeded in record time probably has never been matched in the history of the Medical Service. The same fine spirit was shown by the Medical Service Corps officers who were alerted and sent to the Far East Command on short notice, and by the members of all corps who have subsequently been assigned to the Far East or to units destined for that command. In spirit and in fact, our Army Medical officers today are true descendants of the great men of our earlier years.

Anyone who chooses medicine as a career is an exceptional person. The long years of preparation, the exacting work, the disappointments and frustration do not appeal to a mediocre person. Only a superior

person embraces the medical profession, and in the words of the Hippocratic Oath promises

"\* \* \* with purity and holiness I will pass my life and practice my art \* \* \* Into whatever houses I enter, I will go into them for the benefit of the sick, and will abstain from every voluntary act of mischief and corruption, \* \* \*. Whatever, in connection with my professional practice, or not in connection with it, I see or hear, in the life of men, which ought not to be spoken of abroad I will not divulge, as reckoning that all such should be kept secret. While I continue to keep this oath inviolated, may it be granted to me to enjoy life and the practice of the art, respected by all men, in all times, but should I trespass and violate this oath, may the reverse be my lot."

In short, doctors are an extraordinary group

The same is true of men who choose the Army. An officer does not take a commission for financial gain, which is small, nor for an easy life, which is not the Army life; nor for glory, of which there is little. It is a sincere and able man or woman who qualifies for there is little, then takes the oath "that I will support and defend the Constitution of the United States against all enemies, foreign and domestic, that I will bear true faith and allegiance to the same, that I take this obligation freely, without any mental reservation or purpose of evasion, and that I will well and faithfully discharge the duties of the office upon which I am about to enter."

It is such men and women who make up the Army Medical Service. To them, in the last several years, we have been able to offer excellent additional training. The residency training program in particular has been a boon to the members of the Medical Corps. The other corps also have benefited from the variety of intensive training programs that have been in effect.

When you take such a group and permit them to continue with graduate studies while they gain the experience that Army medicine offers, you cannot help getting a superior product. Such people work and study eagerly and get the fullest benefit from their experience. Good practitioners to begin with, they become better physicians, better nurses, better specialists, better members of our medical team. Thus, the spirit with which our officers are meeting the demands of the Far East emergency is no surprise to us. Nor are we surprised by the efficiency with which those in the Far East Command are handling the medical problems there. The Korean situation has demonstrated the Medical Service.

Our training programs are now paying dividends, and we do not intend to abandon them. They must of necessity be curtailed during

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this emergency, but the Surgeon General has stated that it will be continued at a reduced scale during the emergency period and will be reinstated as quickly as possible with those who have already been selected as the first to reenter the program. Meanwhile, each one in the combat zone or in an emergency post here at home, will be more confident, find such service a chance for still another experience and benefit accordingly.











## BOOK REVIEWS

**RADILOGIC EXPLORATION OF THE BRONCHI** by S. di Renzo, M. D., Assistant Professor of Radiology and Physiotherapy Chief of the Radiology Department of the Institute of Cancer, The University of Cordoba, Argentina. Translated by Thomas A. Hughes, M. D., with a foreword by Richard H. Creath, M. D. 312 pages. Illustrated. Charles C. Thomas, Publisher, Springfield, Ill. 1949. Price \$10.75.

This book should be of value to the radiologist, physician and surgeon because it stresses the assistance of good bronchography in both the diagnosis and precise localization of pathologic lung changes. The fact that the book contains numerous typographical errors and that some of the terminology is strange to the North American student should not detract from its over-all value. In the discussion of both normal and pathologic conditions, the dynamics of the respiratory tree as revealed by the bronchographic procedure are continually emphasized. The book is profusely illustrated.

The first few chapters review in some detail the embryology and anatomy of the pulmonary tree, the dynamic characteristics of the normal lung (and cough reflex), and the technique employed in radiographic exploration of the bronchi.

Bronchial mucosal malformations, bronchiectasis, emphysema, asthma, carcinoma and bronchitis are extensively discussed. The value of bronchography is overemphasized in the detection of bronchogenic carcinoma. Bronchoscopy appears recommended chiefly as a final confirmatory measure and other diagnostic techniques are glossed over. Bronchography is undoubtedly of value, however, in supportive disease to (a) locate and outline small and otherwise obscure tracheobronchial lesions; (b) detect peribronchial concurrent disease (such as asthma); and (c) check the results of treatment.

The book's greatest value is in stressing the versatility of bronchography alone or in conjunction with the usual diagnostic procedures.—Lt. F. W. Meyer, Jr., U.S.N.C. I-83.

**ANAL RECTAL SURGICAL COMPLICATIONS AND TREATMENT** by Harry F. Doty, B. S., M. D., F. A. C. P., F. A. S. P. L., S. F. R. S. M. Professor and Head of Department of Proctology, Temple University Medical School and Hospital; Head of Department, St. Mary's Hospital, formerly Associate Professor, Graduate School of Medicine, University of Pennsylvania; Consultant, Rock Hospital for Tuberculosis, National Stomach Hospital, Duvalais Hospital, Mercy Hospital, Shriners Hospital for Crippled Children, Paul Knabell Hospital, St. Christopher's Hospital and Melrose Hospital; Honorary Fellow, Royal Society of Medicine (London); Embrose Park Surgical Society; Past President, Pennsylvania Surgical Society; Twin State Encouragement Surgical Society; Princeton Surgical Society; Member Correspondiente, Sociedad de Cirugia, Sociedad Brasileira de Proctologia, Pan-American Gastroenterological Society; Honorary Detroit Academy of Surgery; Holloman Academy of Medicine; Diplomatic American Board of Surgery; Surgery Qualification Board; International College of Surgeons; Member, American Board of Proctology; Director, American Cancer Society; President, American Proctologic Society. 2d edition in two volumes. Volumes I and II. 1127 pages entirely revised and most profusely illustrated. J. B. Lippincott Co., Philadelphia, Pa., publishers. 1949. Price \$30. set.

This third edition includes new chapters on malformations of the colon, megarectum, diverticulosis and diverticulitis, antihyperglycials, transplantation.

Abdominoperineal proctosigmoidectomy without colostomy and with preservation of the anal sphincter muscles (the popularly termed "pull-through" operation) is extensively discussed. In presenting the operation, Dr. Bacon states " \* \* It is the desire of the author to render an honest and unbiased opinion of his experience in a group of patients (undergoing 'proctosigmoidectomy') sufficiently large for the reader to judge the merit of such opinion and form his own conclusions therefrom." The author presents the operation only as a part of the armamentarium of the surgeon, and gives definite indications and contraindications for its use.

The Miles operation and seven other "standard" operations, including the Labey, Mikulicz-Rankin, Lockhart-Mummery, and Hartman anterior resection operations are adequately described. Dr. Bacon gives unqualified approval of Dennis' employment of vagotomy in the treatment of ulcerative colitis; however, this procedure is considered experimental by many, including Dennis.

The detailed and complete chapters on anatomy with emphasis on clinical application and surgical significance show the author to be a master in this field of anatomy.

The numerous illustrations in black and white and in color are, for the most part, superb. Some of the plates would be of greater value if they were larger, especially plate 13, one of the key plates of proctosigmoidectomy. It is believed the illustrations would be more effective and of greater value if each were captioned so that they would be self-explanatory, and if the illustrated steps in operations were printed in closer correlation with the descriptive portion of the text. Figures 653 and 654 seem to be entirely astray. Figures 630 and 637 are reversed in operative sequence.

All in all this work is a classic and is all that the author intends—a source book of operative procedures on the anus, rectum, and sigmoid colon. It should be in the library of all proctologists and general surgeons, and should be available to all residents and interns—Captain E. S. Loize (MC) U. S. N.

**ESSENTIAL UROLOGY**, by Fletcher H. Colby, M.D., *Chief of the Urological Service, Massachusetts General Hospital; Assistant Clinical Professor of Genito-Urinary Surgery, Harvard Medical School, Boston, Mass.; Urological Consultant, Lakeville State Sanitarium, Middleboro, Mass.* 580 pages; Illustrated. The Williams & Wilkins Co., Baltimore, Md., publishers, 1939. Price \$8.

This book is a needed addition to our urologic texts in that it is brief, yet thorough, clearly written, and strongly supported by good illustrations. It also brings us up to date on the policies of modern therapy, giving basic principles rather than details. The first part deals with the embryology, physiology, and anatomy of the urinary tract from a clinical rather than from a basic science viewpoint. Residents and candidates for examinations will find it pleasant to read and informative. The second section emphasizes the importance of a well-conducted history and physical examination. A method is presented with pertinent comments. Retrograde and intravenous urography are discussed, present-

ing technic and risks. Part 3 takes up diseases of the genitourinary organs and is the major portion of the book. The anatomic structures are treated in order: kidney, ureter, bladder, et cetera. The general plan is the presentation of an introduction, the pathology, symptoms, diagnosis, and treatment of each disease. These are modified when indicated. The discussion of each disease or subject is followed by a well-written summary of facts and has been condensed beautifully for easy reading. It has an extensive bibliography.—*Col E C Lorrer, MC, U.S.A.*

**THE MANAGEMENT OF THE PATIENT WITH SEVERE BRONCHIAL ASTHMA,** by Maurice S. Segal, M.D., Assistant Professor in Medicine, Tufts College Medical School, Director Department of Inhalational Therapy Boston City Hospital, Boston, Mass. (Publication No. 76, American Lecture Series). 175 pages. Charles C Thomas Publisher Springfield, Ill., 1950. Price \$3.50

This small volume is No. 76 in the American Lectures in Chest Diseases edited by J. Arthur Meyers, University of Minnesota Medical School. It is devoted entirely to a discussion of severe bronchial asthma, and the recommendations for treatment are based on the author's series of over 500 patients. The book begins with a discussion of the clinical concept of bronchial asthma, followed by an explanation of the allergic concept. The author stresses the fact that there is no clear-cut division between extrinsic and intrinsic asthma and emphasizes that most patients can fall in either category. He proposes a classification based on the age of the patient, phase of the disease (whether acute, recurrent, or chronic), responsible factors, and complications. From a clinical viewpoint this is most valuable.

The book consists of 10 chapters followed by a bibliography and index. Individual chapters are devoted to the management of infection, bronchial evanescence, therapeutic use of gases, epinephrine, sedatives, and supportive therapy. The importance of the immediate nonspecific treatment during the acute attack is emphasized with little discussion of long-term allergic management. The author points out the danger of giving morphine in severe bronchial asthma and describes the death of 3 of his patients following the use of this drug. He recommends use of demerol hydrochloride in place of morphine; the reviewer believes that demerol also has little place in treatment of asthma because of the possibility of addiction when used in any chronic or recurrent condition. Chloral hydrate and sodium bromide as recommended for sedation by the author are most effective.

In the management of status asthmatics the author emphasizes that intake and output should be measured and recorded in all these patients. This will reinforce the excellence of this advice and its aid in treatment. Of interest was the author's opinion that self-medication with epinephrine should be avoided because patients with asthma tend to become dependent on this drug. This monograph includes a comprehensive discussion of all phases of the treatment of asthma and will prove of great value to general practitioners and specialists alike.—*Col H. H. Dusser, MC, U.S.A.*

**MEDICAL GYNECOLOGY,** by James C. Jamies, M.D., F.A.C.S., Associate Professor of Gynecology, Boston University School of Medicine; Associate Visiting Gynecologist, Massachusetts Memorial Hospitals. 2d edition. 474 pages, illustrated. W.B. Saunders Co., Philadelphia, Pa., publishers, 1950. Price \$6.50

This is a book for the general practitioner and describes office diagnosis and treatment in gynecology. Only operative procedures simply enough to be performed in the office are discussed. The author stresses the patient's complaints and the importance of the gynecologic history in diagnosis; discusses examination

tion of the patient, including the difficulties to be met and overcome gives his procedures in differential diagnosis and treatment. He also includes a section on sociomedical care for which the gynecologist and the general practitioner are often consulted. In this section Dr. Janney shares his long experience in the care of such problems as premarital care, marital maladjustment, sterility, and fertility.—Commander M. A. Godinez, MC, U. S. N. and Lt (jg) R. L. Stont, MC, U. S. N. R.

**Lipidoses, Diseases of the Cellular Lipid Metabolism**, by Siegfried J. Thannhauser, M. D., Ph. D., Associate Professor of Medicine, Tufts College Medical School; Associate Physician-in-Chief, Joseph H. Pratt Diagnostic Hospital, Boston, Mass., edited by Henry A. Christian, A. M., M. D., LL. D., Sc. D. (Hon.), M. A. C. P., Hon. F. R. C. P. (Can.), D. S. M. (A. M. A.) Hersey Professor of the Theory and Practice of Physic, Emeritus Harvard University; Sometime Clinical Professor of Medicine, Tufts Medical School; Sometime Physician-in-Chief, Carney Hospital; Sometime Visiting Physician, Beth Israel Hospital; Physician-in-Chief, Emeritus, Peter Bent Brigham Hospital, Boston, Mass. (Reprinted from Oxford Loos-Leaf Medicine with the same page numbers as in that work.) 605 pages; Illustrated. Oxford University Press, New York, N. Y., publishers, 1950. Price \$12.

This book represents an excellent detailed summary of lipid and allied metabolic disorders. Supporting this is a good discussion of both diagnostic and laboratory procedures as each pertain to the recognizable lipidoses and pathologic syndromes, plus a chapter on the physiology and chemistry of fat. The previously established clinical syndromes in this field are used as divisions for discussion but in several instances (essential xanthomatosis) further differentiation has been offered (xanthomatous biliary cirrhosis). More recent ideas on the enzymatic disintegration of fats and the interrelationships with protein and carbohydrate metabolism are well discussed. This book is a valuable contribution to the library of internists, clinical physiologists, and pathologists who may from time to time have occasion for reference to an authoritative work on lipidoses.—Lt Col. F. L. Bauer, MC, U. S. A.

**GIVING LEARNING EXPERIENCE**, Principles of Progressive Education Applied to Nursing Education, by Maude B. Muse, R. N., A. M., formerly, Associate Professor of Nursing Education, Teachers College, Columbia University. 617 pages. The Macmillan Co., New York, N. Y., publishers, 1950. Price \$4.50.

This book is written primarily for the experienced and the prospective nurse educator. The author, who has written other books on this subject, is a recognized authority. After many years of teaching and nursing, and continued study of educational theories, she became a professor in nursing. She encourages the nurse educator to adopt modern methods of teaching.

The book is divided into four parts. The first discusses and compares three educational philosophies: The traditional, the free school, and modern progressive education. The advantages and benefits derived from the progressive system in general and professional education are enumerated. The second part explains the nature and source of the principles of education and the purpose and role they play in learning. The chapters in this unit are devoted chiefly to the teaching-learning principles. They familiarize the teacher who seeks the goals of progressive education with the learning processes and other interrelated factors which constitute a sound teaching program for the learner. The third part applies these principles to clinical instruction. The last part discusses the

various methods used in planning a teaching program. The suggested activities at the end of each chapter are especially helpful in organizing a teaching program—*Lt H J Toporek, MC, U. S. A.*

**ANTIBIOTICS.** A Survey of Penicillin, Streptomycin and Other Antibacterial Substances from Fungi, Actinomycetes, Bacteria, and Plants, by H. S. Florey, M. A., M. B., Ph. D., F. R. S., E. Chain, M. A., Ph. D., F. R. S., N. G. Heatley, M. A., Ph. D., M. A. Jennings, M. A., B. M.; A. G. Sanders, M. A., M. B., Ph. D.; E. P. Abraham, M. A., Ph. D., and M. E. Florey, M. B., B. S. In two volumes. 1774 pages. Illustrated. Oxford University Press, New York, N. Y., publishers, 1949. Price \$20.75 (not sold separately).

This set of books is a virtual encyclopedia on penicillin and streptomycin. Volume I is devoted entirely to those considerations applicable to all antibiotics, i. e., methods of detection, isolation, identification, assay, and methods of purification. This volume also contains an exhaustive history of antibiotics. It is of interest that the first reference to the use of specific micro-organisms to combat other micro-organisms was published in 1852. Yet in December 1940 Wakeman and Dubos were unsuccessful in an attempt to hold a round-table discussion on "the production of antibacterial substances by micro-organisms" because not enough scientists were interested.

Volume II is devoted almost exclusively to penicillin and streptomycin. The first few chapters give detailed information on the known sources of penicillin, its production, chemical and physical properties, and synthesis. Following this are several chapters dealing with the susceptibility of micro-organisms to penicillin, their acquired resistance, the production of penicillase, and the mode of action of penicillin on micro-organisms. This section closes with several chapters on the pharmacology of penicillin. Streptomycin and diphtheria toxin are handled in much the same fashion as penicillin except in somewhat less detail.

A comprehensive appendix contains information on the more recently discovered antibiotics as well as new knowledge of the older ones. At the end of this appendix a table lists most of the known antibiotics along with their important properties. This set of books is extremely valuable to the research workers and as a reference work in medical libraries. Its size, comprehensive detail, and cost will limit its value to the practicing physician—*Lt Col, R. P. Mason, MC, U. S. A.*

**1949 YEAR BOOK OF ENDOCRINOLOGY, METABOLISM AND NUTRITION** (December 1948-January 1949). Endocrinology edited by Willard O. Thompson, M. D., Clinical Professor of Medicine, University of Illinois College of Medicine, Attending Physician (Senior Staff), Hennepin Hospital, Attending Physician, Grant Hospital of Chicago. Metabolism and Nutrition edited by Tom D. Spies, M. D., Chairman, Department of Nutrition and Metabolism, Northwestern University School of Medicine, Director, Nutrition Clinic, Hiltman Hospital, Birmingham, Ill. 547 pages, illustrated. The Year Book Publishers, Inc., Chicago, Ill., publishers, 1950. Price \$4.75.

This is an excellent reference for the busy physician who wants to keep abreast of the recent advances in clinical endocrinology, diseases of metabolism, and nutritional therapy. The book is in two sections. The first section devoted to endocrinology is edited by Dr. Thompson. Particular emphasis is put on adrenocorticotrophic hormones and 11-hydroxy-17-dehydrocorticosterone (cortisone). The second section, devoted to metabolism and nutrition and

edited by Dr. Spies, is a concise résumé of the diseases of metabolism and their treatment. Pancreatic and liver function are discussed in detail. The physician may use the book as a ready reference, but with more leisure, he will want to read it all. A valuable feature is the Year Book Quiz of 20 questions that appears on the cover.—Commander J. B. Barger, MC, U.S.N.

**A TEXTBOOK OF DENTAL ANATOMY AND PHYSIOLOGY** by Russell C. Wheeler, D.D.S., F.A.C.D., Associate Professor of Anatomy at Washington University School of Dentistry, Saint Louis. 2d edition. 422 pages, illustrated. W.B. Saunders Co., Philadelphia, Pa., publishers, 1950. Price \$6.75.

This is the second edition of a textbook on the fundamental forms, alignment, and occlusion of human teeth. The material covered serves as a background for all phases of dental practice. The 16 chapters comprising this text include the gross anatomy of the individual teeth, their anatomy on cross section, their occlusion during various jaw relations, and the significance of the foregoing during function. The illustrations are excellent. This book is recommended as a text for dental students.—Capt. W. J. Marus, U.S. AIR FORCE (DC)

**MODERN PRACTICE IN DERMATOLOGY**, edited by G. B. Mitchell-Heggs, O.B.E., M.D., F.R.C.P., Physician-in-Charge, Skin Department, St. Mary's Hospital and Medical School, London; Physician, St. John's Hospital for Diseases of the Skin and Institute of Dermatology, University of London; Member Advisory Panel on Dermatitis, Ministry of Labour and National Service. 836 pages; illustrated. Paul B. Hoeber, Inc., New York, N.Y., publisher, 1950. Price \$12.50.

This most recent compilation of correlated monographs by British dermatologists contains fresh and timely material presented in an arresting fashion. It is offered to senior students of dermatology and general practitioners. The fully qualified dermatologist can also find much of interest and value in this symposium. The editor and his 40 contributors in 50 chapters treat the subject of dermatology not only along the conventional lines of morphology and systems, but discuss the topographic, climatic, and social aspects as well. Such duplication as has resulted from these different approaches is advantageous from the standpoint of teaching. Of special interest are sections on psychosomatic aspects, the role of insects and parasites, the relationship to internal medicine, rehabilitation, technique of biopsy, and social aspects. The timeliness of the book is demonstrated by the inclusion of radiation blast injuries. Although little space is devoted to syphilis the subject is adequately covered. The illustrations are admirable and the subjects of the color plates well chosen. Unlike many British texts this volume is readily adaptable to the conditions of American dermatology.—Capt. R. L. Gilman, MC, U.S.N.

**PRINCIPLES AND PRACTICE OF PLASTIC SURGERY**, by Arthur Joseph Barsky, M.D., D.D.S., Attending Plastic Surgeon, Beth Israel Hospital, New York City; Attending Plastic Surgeon, Morrisania City Hospital, New York City; Attending Plastic Surgeon, Bronx Hospital, New York; Attending Plastic Surgeon, Beth-El Hospital, Brooklyn, N.Y.; Attending Plastic Surgeon, New York State Rehabilitation Hospital, Westchester, N.Y.; Clinical Professor of Surgery and Associate Surgeon, New York Polytechnic Medical School and Hospital; American Board of Plastic Surgery; International Society of Plastic and Reconstructive Surgery; American Association of Military Surgeons; Associate Member of British Association of Plastic Surgeons; Associate Member of Mexican Association of Plastic Surgery.

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*Volume 4 No 4*  
*Formerly Lieutenant Colonel, U. S. A. 474 pages. Illustrated. Price \$10*  
*Williams & Wilkins Co., Baltimore, Md., publishers, 1950.*  
 The first six chapters deal with the practice of plastic surgery, especially emphasis being given to the fundamental principles of plastic surgery, especially emphasized by other plastic surgeons. The final chapters deal with the practice of plastic surgery, especially emphasized by other plastic surgeons. The book is well written and well illustrated. The author has presented in most cases the subjects concisely without tending to over-magnification. Variations of excision, repair, and x-ray and radiation treatment of keloids and hyperplastic scars are included. Very little material is presented, however, to show the descriptive various ways of preparing casts and masks which would be of special interest to any one performing operations in oral surgery and restorative prostheses.—Lt. Col. J. T. Guinnin, MC

*MARRIAGE IS WHAT YOU MAKE IT. by Paul Popowich, Sc. D. General Director, The American Institute of Fat & Hair Relations, Los Angeles, Calif. 221 pages  
 The Macmillan Co., New York, N. Y. publishers, 1950. Price \$1*

Dr. Popowich points out in this compact volume that most of the failures in marriage are unnecessary and could have been prevented by proper education before marriage. He demonstrates convincingly that it is the principles of helping a person to understand his marital problems by giving him a mature insight into his own personality structure as well as that of his partner. The author's technique is based on sound and accepted psychological principles and discourses practical methods of helping people to live the married life. Although this book would be of great value to any reader interested in securing a happy marriage for himself, it is also an invaluable contribution to the libraries of psychologists, psychiatrists, and social workers who engage in the practice of marriage counseling.—  
 Lt. Col. F. R. Dooley, MC, U. S. A.

*The Cerebral Convexity or MAN. A Clinical Study of Localization of Function in Wilder Penfield C. M. G. M. D. (Johns Hopkins) B. Sc. and D. Sc (Oxon.) Hon. F. R. C. S. (Lond.) F. R. S. Professor of Neurology and Neurosurgery McGill University, M. D. Professor of Neurosurgery McGill University, and Theodore Rasmussen, M. D. Professor in Neurosurgery, University of Chicago, formerly Lecturer in Neurosurgery, McGill University, Assistant Surgeon, Montreal Neurological Institute. 218 pages. Illustrated. The Macmillan Co., New York N. Y. publishers, 1950. Price \$6.50*

This excellent study reports the results of cortical stimulation of over 5000 anesthetized patients under local anesthesia. It constitutes significantly to our understanding of cortical function. There is an excellent histologic description of the subject. The data and conclusions are presented clearly. The book should be read by all neurologists, neurosurgeons, and psychiatrists.—Lt. Col. S. H. Hanson, U. S. A.

*HANDBOOK OF PHYSICAL MEDICINE AND REHABILITATION. Selections Authorized for Publication by the Council on Physical Medicine and Rehabilitation of American Medical Association. 573 pages; Illustrated. Published for*

**the American Medical Association by The Blakiston Co., Philadelphia, Pa., 1950. Price \$4.25.**

This well-known handbook appears as a first edition at this time because of a change in title and the inclusion of "Rehabilitation" not included in the previous editions, the first of which appeared in 1932 as "The Handbook of Physical Therapy" and later editions appeared as "The Handbook of Physical Medicine." The addition of "Rehabilitation" broadens the scope of this edition to include all the medical, psychologic, and social services whereby a person recovering from disease or disability is taught to live and work. This required the marshaling of physical medicine, psychosocial adjustment, and vocational training to achieve maximal function of the individual and to prepare him completely for the fullest possible life compatible with his abilities and disabilities. The book is composed of a series of monographs on special subjects, some revised and rewritten and some, such as those on the physiologic effects of heat, the physiologic aspects of therapeutic exercise, the basic principles of therapeutic exercise, problems in hearing, physical medicine in ophthalmology, occupational therapy, and rehabilitation, entirely new. The new chapter on physical medicine in psychiatric practice is especially appropriate and adds to the value of this book. An effort is made to separate the useful from the useless among existing devices and procedures as well as to bring about a closer union between general medicine and surgery on the one hand and physical medicine and rehabilitation on the other. The book is attractive in appearance, logical in arrangement, and has an excellent index. An appendix presents a complete list of motion-picture films and lantern slides on physical medicine and rehabilitation.—*Lt. Col. J. H. Kuitert, MC, U.S.A.*

**Light Therapy, by Richard Kovacs, M. D., Professor of Physical Medicine, New York Polytechnic Medical School and Hospital. Publication Number 57, American Lecture Series. 112 pages; Illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1950. Price \$2.25.**

This interesting monograph covers in lucid detail the story and present status of light therapy. It briefly outlines the advantages of radiant energy in the various phases of the medical spectrum, indications for clinical use are clearly outlined, and physiologic effects to be anticipated are tabulated. Contraindications and dangers of the various forms of treatment are mentioned. A short chapter on the physics of radiant energy gives a clear and concise understanding of light therapy fundamentals. This handbook is highly recommended to the busy practitioner who uses any form of light therapy. It also will be found valuable in the training of medical students, interns, nurses, and physical therapy students.—*Lt. Col. R. J. Healy, Jr., MC, U.S.A.*

**GENTO-URINARY SURGERY, by Sir John Thomson-Walker, D. L., M. B., C. M. 151, F. R. C. S. Eng., Consulting Urologist and Emeritus Lecturer on Urology, King's College Hospital; Consulting Surgeon, St. Peter's Hospital; President V Congress of Societe Internationale d'Urologie; Hunterian Professor Royal College of Surgeons 1937; Lettsomian Lecturer, 1939; President Medical Society of London, 1933. Edited and revised by Kenneth Walker, M. A., M. B., B. C. (Cambridge), F. R. C. S. Eng., T. I. C. S., Jackman Professor and Hunterian Professor, Royal College of Surgeons, 1941, 1942, 1943, 1944; Emeritus Surgeon to the Gento-Urology Department, Royal Northern Hospital; Urologist, Harrow Central and Duffield County Hospitals; Member of La Societe Internationale d'Urologie; Fellow of International College of Surgeons. 3d edition. 856 pages, with 25 color**

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and 53 black-and-white plates, and 242 illustrations in the text. Paul B. Hoeber, Inc., New York, N.Y., publisher, 1970. Price \$15.

This book of English publication is a thorough and complete treatise on genitourinary surgery. With the exception of the antibiotics that have been developed subsequent to penicillin it is entirely up to date. The sections, including excellent illustrations on surgical anatomy and technic are of particular excellence and make this book a valuable addition to the urologist's library. Because of its highly technical nature, however, it is not deemed suitable as a textbook for use in the training of medical students and physicians not specializing in urology.—Commander M. A. Curtis, MC, U.S.N.

**WORLD SURGERY**, 1970 by Stephen A. Ziemann, M.A.M.D., F.A.C.S., F.I.C.S., Abstract and News Editor, *Journal of the International College of Surgeons*; Abtracter for *International Abstracts of Surgery and Gynecology*; *Gynecology and Obstetrics, formerly Tumor and Assistant Editor, Army Bureau of Medicine and Surgery*, 177 pages, 53 illustrations. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1970. Price \$6.

This selection of abstracts from the world's surgical literature is exceptionally readable. The list of contents is so arranged that almost any abstract can be located at a glance without consulting the more complete subject index in the back. Reader interest is further enhanced by the quality of the paper, type, and spacing used. Although it would appear impossible to abstract the many journals and subjects that flood the surgical literature today in a single volume of 177 pages, as the individual abstracts are read the reader begins to realize that the author has picked out articles that are interesting as well as practical. The choice of articles abstracted is well-balanced and includes rarities and more unusual problems. Dr. Ziemann does not comment on the articles abstracted but his manner of writing imparts a definite feeling of confidence in certain of the articles while in others the reader is left to consider several different approaches to the problem involved.

The book is divided into 10 sections: gastrointestinal surgery, cardiovascular, respiratory surgery, gynecology, obstetrics, orthopedics, genitourinary surgery, neurosurgery and paravertebral, orthopedics, and otolaryngology; surgery of the head and neck, and a miscellaneous section dealing with anaesthesiology, radiology, proctology and postoperative care, and antibiotics. General interest in abundance of material, new ideas and new techniques have been used as a guide in allotting space to the various sections of the book. The sections on gastrointestinal surgery and cardiovacular-respiratory surgery are especially comprehensive. Although certain chapters such as those on neurosurgery and psychosurgery, and ophthalmology and otolaryngology may be of little interest to many general surgeons, they provide a pleasant and easy way of forming a speaking acquaintance with the newer trends in these specialties.

The references cited seem reasonably complete and there are conveniently located at the end of each abstract. In compiling the book, Dr. Ziemann has made good use of his known ability as an abstractor, linguist, author, and practical surgeon. To quote from the foreword by Dr. Max Thorek, "World Surgery, 1970, meets a need not filled by the conventional textbooks. Yet it contains elements that appear specialized manual of surgical technique. Yet it contains elements that appear in them all, plus a certain literary prospective and sense of proportion that lifts it beyond the usual in its field"—Capt. H. S. Lawler, MC, U.S.A.



*The opinions expressed in this publication are not necessarily those of the Department of the Army, Department of the Navy, Department of the Air Force, or Department of Defense. References to regulations, orders, circular letters, or directives are for information only and do not, by publication herein, constitute authority for action.*

*Any reference in an article of this publication to a proprietary drug or its chemical formula shall not constitute an endorsement of its efficacy or use in the treatment of any disease.*

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Subscriptions should be sent to the Superintendent of Documents, United States Government Printing Office, Washington 25, D. C.

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#### COVER PHOTOGRAPH

*Medical Services personnel cut blood-soaked clothing from wound of a South Korean Marine shot as United Nations' forces pushed along the road between Inchon and Seoul. Site is a roadside aid station near the front lines.*

VOL. I

DECEMBER 1950

NO. 12

# UNITED STATES ARMED FORCES MEDICAL JOURNAL

*Published Monthly by the Armed Forces Medical Publication Agency, Department of Defense*



FREDERIC W. FARRAR, Captain, MC, U. S. N., Editor-in-Chief  
WAYNE G. BRANDSTADT, Colonel, MC, U. S. A., Associate Editor  
ROBERT J. BENFORD, Colonel, U. S. A. F. (MC), Associate Editor

THE PRINTING OF THIS PUBLICATION HAS BEEN APPROVED BY  
THE DIRECTOR OF THE BUREAU OF THE BUDGET, OCT 12, 1949

UNITED STATES  
GOVERNMENT PRINTING OFFICE  
WASHINGTON . 1950

## Foreword

The UNITED STATES ARMED FORCES MEDICAL JOURNAL represents the unification of the BULLETIN OF THE UNITED STATES ARMY MEDICAL DEPARTMENT, published since 1922, and the UNITED STATES NAVAL MEDICAL BULLETIN, published since 1907. This joint periodical is the medium for disseminating information of administrative and professional interest to all medical personnel of the Department of Defense.

It is the aim to include in each issue administrative directives, original scientific and professional articles, editorial comments on current professional literature of special interest, clinical notes, descriptions of new devices and instruments, abstracts of articles from various medical periodicals, and notices and reviews of newly published professional books of interest to all commissioned medical personnel of the Department of Defense.

The Director, Medical Services, and the Surgeons General of the several services extend an invitation to all medical officers, dental officers, Medical Service Corps officers, Nurse Corps officers, officers of the Veterinary Corps, all officers of the ancillary services of the medical services of the Armed Forces, and to the medical consultants of the Army, Navy, and Air Force to submit manuscripts for publication in this JOURNAL.

RICHARD L. NEILING, M. D.,  
*Director, Medical Services,  
Department of Defense.*

RAYMOND W. BLISS,  
*Major General, U. S. A.,  
Surgeon General, U. S. Army.*

CLIFFORD A. SWANSON,  
*Rear Admiral, MC, U. S. N.,  
Surgeon General, U. S. Navy.*

HARRY G. ARMSTRONG,  
*Major General, U. S. A. F.,  
Surgeon General, U. S. Air Force.*

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Address: U. S. Armed Forces Medical Journal, Bureau of Medicine and Surgery, Department of the Navy, Washington 25, D. C.

FREDERIC W. FARRAR, *Editor-in-Chief,*  
*Captain, Medical Corps,*  
*United States Navy*

WATSON G. BRANDSTADT, *Associate Editor,*  
*Colonel, Medical Corps,*  
*United States Army*

ROBERT J. BENFORD, *Associate Editor,*  
*Colonel, Medical Corps,*  
*United States Air Force.*

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OFFICE OF THE SECRETARY OF DEFENSE  
WASHINGTON, D.C.

MEMO To Personnel of the Medical Services of the  
United States Armed Forces

The ideals embodied in the spirit of Christmas are a reminder of the goal of free people everywhere - the goal of peace, which has been a beacon light to struggling mankind for all these years.

This Christmas season will find many of us away from our homes, serving wherever the country's needs dictate. Each of us faces certain problems and certain sacrifices in his job requirements. Yet our efforts will seem a small contribution, indeed, if the reward is Peace on Earth, Good Will to All.

A Merry Christmas and a Joyous New Year to every one of you.

*Richard L. Walling*

Richard L. Walling, M.D.  
Director of Medical Services

# UNITED STATES ARMED FORCES MEDICAL JOURNAL

Volume I

December 1943

Number 10

## Psychiatric Treatment in Combat Areas

SARAH W. REED, M.D., U.S.A.M.C. (M.C.)

**P**RIVILEGED marshes will be the movable nests of the present battle in Korea. We can apply the best we learned of World War II in their treatment. The closest contact and proximity of the combat areas to the easily influenced by group and social movements. This fundamental point was forgotten in the opening phases of World War II, in the North African Campaign. Individualism was dominant in both general members and members of military companies so that sound administrative and organizational policies were abandoned in combat in Italy and Europe until dramatic effect. This provided the treatment as far forward as possible. A U.S. demand for maximum combat training achieved its way of improvement in morale and performance of psychiatric treatment and prevention. Emphasis was placed on prevention of mental discipline, shortening of the period of hospitalization, and cure of minor mental hospital admissions, and promotion in the patient of the expectation of return to full duty. Control in terms of psychiatric services organization and administration of forward area psychiatric treatment and prevention of the patient's identification with the combat groups.<sup>1</sup> Minimization of the combat zone of memory through and avoidance of discussion of those and situations. Thus, three-pronged principles were implemented by simple

1. Johnson and Adams in *Psychiatric Warfare Areas in the Korean War*. *Medical Record*, 1943.

2. The following are well established rules. They are of value to prevent mental health problems. 1. Avoid extreme fatigue. 2. Avoid heat. 3. Avoid noise. 4. Avoid rain. 5. Avoid cold. 6. Avoid dust. 7. Avoid smoke. 8. Avoid alcohol. 9. Avoid fatigue.

manipulation. The success of such measures was one of the most important medical lessons of World War II.

Soldiers who became psychiatric casualties on the battlefield received what may be called psychiatric first aid from members of their own combat unit. If evacuated from their unit, they were first seen in medical channels at the *Battalion Aid Station* where simple, but for many patients definitive, therapy was undertaken. A high percentage of patients were returned from this level to full duty. Those who were evacuated received further evaluation and treatment at the *Division Clearing Station*, where treatment was under the direction of the division psychiatrist. From 20 to 10 percent of all psychiatric casualties were returned to full duty from this point. Patients requiring more prolonged care and treatment and who were not considered salvageable for combat duty in the division within the time limits established were evacuated to the *Army Neuropsychiatric Treatment Station*, operating on evacuation hospital level under control of the Army surgeon. The latter station also received overloads from the division psychiatric facilities at times when casualties exceeded their capabilities. The Army Neuropsychiatric Treatment Stations held and treated patients for usually not more than 5 days. No psychiatric patients were evacuated from Army without passing through one of these installations. From 10 to 20 percent of all patients were returned to full combat duty from this level.<sup>3</sup>

Treatment methods at the Division Clearing Station and at the Army Neuropsychiatric Treatment Station did not differ markedly. Both rendered definitive care to a high percentage of patients evacuated to them. In the discussion of treatment methods which follows, they are considered together.

#### TREATMENT WITHIN THE COMBAT UNIT

Unit personnel were the first to deal with the soldier with psychiatric complaints. The importance of their handling of the problem often went unrecognized, but was fully as great as that of surgical first aid. The most successful programs of saturated area psychiatric treatment (e.g., in the 3d and 86th Infantry Divisions) placed much emphasis on indoctrination of company officers in proper methods of management of psychiatric complaints at this level. The division psychiatrist, 3d Infantry Division, outlined the principles to be followed to all infantry officers routinely at the time they first reported for duty in the division. A similar program was followed in the 86th Infantry Division.<sup>4</sup> In both of these divisions, indoctrination of

<sup>3</sup> Training Circular, No. 6-7 April 1950.

<sup>4</sup> Glass, A. H. Psychiatry at the division level. Bull. U. S. Army M. Dept. (supp.) pp. 45-73, Nov. 1949.

company officers was continued during frequent visits of the division psychiatrist to individual units.

Proper first aid, either surgical or psychiatric, always entails an assessment of the severity of the patient's condition and a decision concerning the need for more definitive medical care. Consequently, company officers were instructed in the criteria to be followed in making such decisions in psychiatric problems, and were encouraged to develop confidence in their common-sense ability to "size up" patients with psychiatric complaints. It was a well-recognized principle of surgical first aid that soldiers with minor bruises or unimportant lacerations should not be evacuated. Rather, they were kept with their units and given what simple treatment was possible there. Similarly, it was held to be important that company officers not evacuate soldiers with relatively minor psychiatric problems. Such soldiers were much better handled by being given suitable superficial help within their own unit. Company officers encouraged wavering soldiers by exhortation and leadership, by counselling, reassuring, and by making alterations in job assignment in some cases. Thus soldiers with relatively minor complaints were prevented from entering medical channels where the dissolution of group ties, and the factors of secondary gain and suggestion would tend to fix their symptoms.

#### AT BATTALION AID STATION LEVEL

The psychiatric casualty first encountered formal medical treatment (as opposed to "first aid") if he was evacuated to the Battalion Aid Station. Although the battalion surgeon was not a psychiatrist, his management of psychiatric casualties was of a degree of importance difficult to overestimate. Although accurate statistical records were not maintained by battalion surgeons, it has been estimated that at least 60 percent of all psychiatric patients were treated and returned to full duty at this level.<sup>3</sup>

A. *Treatment of fatigue, exhaustion, and effects of exposure.*—The major portion of psychiatric patients admitted to Battalion Aid Stations consisted of soldiers with from mild to moderate anxiety states complicated by physical exhaustion and the effects of exposure. These men were usually wet, cold, dirty, and physically worn out. Any judgment based on the first short interview with them was highly fallible. Although a man might appear to be at the end of his rope one evening, after a good night's rest under sedation in dry clothes and blankets in the luxury of a hayloft, he was often ready and willing

<sup>3</sup> TURNER, C. C.: *Psychiatric Treatment in the Battalion Aid Station.* (Speech given at the Seventh Army Medical Conference, Nov. 1944.) Much of the section of this article which deals with the Battalion Aid Station draws heavily on a transcript of this speech.

to return to his company. Therefore, if at all feasible, borderline cases were kept in the vicinity of the aid station under medical management for 24 hours. The factor of adequate sedation of these acute cases cannot be overemphasized. Most were given from 0.36 to 0.55 grams of sodium amytal orally, or a corresponding dose of one of the other barbiturates. Every attempt was made to aid these soldiers in getting cleaned up, dry, and adequately fed.

It was usually found to be advisable to locate aid stations in buildings if possible because they provided more space for treatment and more apparent safety. It is advisable to say "apparent" because it

adequate shelter.

B. *Psychotherapy* at the Battalion Aid Station varied with the type of patient and was almost invariably, and of necessity, superficial. The attitude of the battalion surgeon was of prime importance in determining the outcome of the case. It was necessary that there be an air of calm confidence in all his decisions. Ideally, he was firm, yet understanding, so that all of his dispositions were regarded as final. His manner and all his remarks indicated that he expected an early return to duty of the soldier after he had rested. Medical discipline was maintained, and every effort was made to avoid allowing the aid station to become confused and crowded with men on doubtful status.

1. *Normal fear reactions*.—A large group of patients manifested symptoms that consisted essentially of no more than the somatic and psychologic manifestations of the normal combat fear reaction. These soldiers were treated by proper examination, evaluation, explanation, and reassurance. Although such management appears simple, mistakes were frequently made.\* These patients were usually sincere. Most frequently they were replacements, or men returning to duty with their organizations after hospitalization. As combat approached, palpitation, nausea, tremulousness, and other somatic manifestations of the usual fear reactions began to manifest themselves. The soldier became alarmed and interpreted these symptoms as those of cardiac, gastrointestinal, or other physical disorders and reported to his medical officer.

It was always important that these patients not be slighted. They were given an examination involving the appropriate organ system. If this was negative they were told so promptly and definitely. The cause of the symptoms was carefully explained to them, and they were

\* BENSON, S. W. Normal battle reaction, its relation to pathologic battle reaction. Bull. U. S. Army M. Dept. (Supp.) pp. 3-11, Nov 1949.

assured that there would be no lasting effects or disability. Sometimes it was of help to invite these men to inquire among their friends concerning their sensations. They were frequently surprised and pleased to find that they did not differ from the men who were carrying on without apparent concern. In any event, if it was possible to carry these men through the first few days of combat, they became acclimated and stopped coming to the aid station.

2. *Mild to moderate anxiety states.*—Patients with from mild to moderate anxiety states with varying degrees of exhaustion and exposure, were treated chiefly by sedation and by measures designed to counteract fatigue and exposure, as outlined above. Psychotherapy, which was superficial, consisted of reassurance, support, and exhortation. After 24 hours many of these patients felt completely recovered or markedly improved and could be returned directly to duty. Others showed little, or insufficient improvement, and were evacuated for further definitive care by the division psychiatrist.

3. *Severe neurotic reactions and psychoses.*—Certain patients were obviously unsuited for management in the Battalion Aid Station. These exhibited disturbed anxiety states with severe agitation and tension; acute panic states; severe hysterical manifestations; and acute psychoses. Although evacuation was the only conceivable disposition for such patients, it was found to be a great mistake simply to pack them into an ambulance and ship them to the rear. It was important that they be adequately sedated to render their evacuation feasible and nontraumatic. The most important consideration was to protect the patient from further psychic trauma in transit. Tense, disturbed soldiers with battle incurred anxiety reactions had a greater than usual tolerance for barbiturates and a much lower than usual threshold for pathologic reactions to combat stimuli. The dose of sedative, therefore, depended on the severity of the patient's reaction and the expected degree of enemy action or other psychic trauma to be encountered along the route of evacuation. The drugs most commonly used were the barbiturates, either orally or (in rare instances) parenterally. The most commonly used drug was sodium amytal in dosages of from 0.36 to 0.55 grains. It was found to be important that sedation be given in sufficient time to reach maximum effect before evacuation was undertaken. Care was taken to avoid converting a walking into a litter case by oversedation. Morphine and other opiates were less satisfactory than the barbiturates and their use was considered to be contraindicated.

4. *Administrative problems.*—Two other types of patients should be mentioned. Their proper management was of great importance in preservation of group morale. The return of patients of these types to full duty was mandatory. The so-called "gold bricks" be-

longed to this group of cases. These consisted of the true, simple malingerer and the soldier with some minor organic or functional condition which he exaggerated. Toward these men the attitude of the surgeon was of necessity one of uncompromising firmness. After a careful medical evaluation, he let the soldier know that he considered the situation trivial, and that it did not merit consideration of relief from duty. This was usually sufficient, but if the soldier persisted in his attitude or refused to accept the situation, reference to the possible consequences of such action usually discouraged further attempts. Habitual stragglers constituted another class of administrative problems requiring management by the battalion surgeon. These were the oh-so-willing soldiers who just could not keep up, or who got lost or misunderstood orders, or produced any number of other excuses leading to their arrival at the aid station when an attack was just getting under way or was momentarily expected. These men were best managed by providing instructions and when possible, guides or transportation back to the company in time to make or receive the attack. In this way, they came to realize that the subterfuge did not "pay off" and entailed only additional trouble and risk.

(a) *Kitchen and service trains.*—In the earlier phases of World War II, acute psychiatric patients frequently were sent to unit kitchens or service trains for rest, after which it was expected that they would return to duty. Although this practice was common at first in the 34th and other divisions in North Africa and Italy, many men not only did not improve under such conditions, but actually reported themselves to be worse and a great deal more tense. Some divisions (especially the 36th and 85th) set up regimental rest centers under the supervision of the regimental surgeon or dental surgeon. Such centers were more successful because they maintained good medical care and discipline—the degree depending largely on the attitude, ability, and insight of the medical officer in charge. Any type of rest without proper administrative control and medical supervision tended to fix symptoms and render return to duty less probable.

In summary, treatment at the Battalion Aid Station involved: (a) maintenance of good medical discipline; (b) the exhibition of an attitude of sympathetic firmness which expected return to full duty of most patients; (c) provision of proper rest and other measures designed to relieve fatigue and the effects of exposure; (d) treatment of as many patients as possible on duty status; and (e) adequate sedation, when indicated, with special emphasis on proper sedation of all patients evacuated to the rear from the aid station.<sup>2</sup>

<sup>2</sup> As general source material on this subject the following article is recommended:  
HORN, R.: Battalion surgeon as psychiatrist. Bull. U. S. Army M. Dept. (Suppl.) pp 36-44, Nov. 1949.

**AT DIVISION CLEARING STATION AND ARMY NEUROPSYCHIATRIC TREATMENT STATION LEVEL**

If evacuated from a Battalion Aid Station, psychiatric patients were received by the division psychiatrist at the Division Clearing Station. At this level, definitive treatment of a large proportion of such patients was undertaken. Those unsuitable for treatment here, and those who had not responded to treatment, were evacuated to the Army Neuropsychiatric Treatment Station. Not infrequently, however, an excessively heavy case load forced the division psychiatrist to evacuate all types of patients, regardless of their suitability for treatment at division level. The Army Station served as a back-stop to the division psychiatrist. Therapy at Division Clearing Station and Army Neuropsychiatric Station levels were therefore interchangeable in a sense. Facilities for treatment were more elaborate at the Army Station, and definitive therapy was carried out in a higher percent of patients than at the Division Clearing Station. Essentially, however, differences in therapy at the two levels at various times resulted chiefly from fluctuations in the military situation, which by overloading the facilities of the division psychiatrist made it necessary for him to evacuate incompletely treated cases to the Army Station. Because the principles of treatment were essentially the same in both places, discussion of treatment at the two levels will be considered in a single section.

A. *Treatment for fatigue and exposure.*—Although a large percent had previously received some treatment for fatigue and exposure at Battalion Aid Stations, many arrived in a state of fatigue; they were cold, dirty, hungry, and worn-out. For these, rest under sedation was promptly instituted. They were placed in adequately heated tent wards, sleeping on cots, under a sufficient number of blankets. Hot food in copious quantities was made available. Most of them were given barbiturates by mouth.

B. *Alleviation of deprivations.*—These men had usually been subjected to many deprivations, both physical and psychologic. At the Division Clearing Station and the Army Neuropsychiatric Treatment Station an attempt was made to alleviate these to the fullest possible extent. The soldier was given a change of clothing, was encouraged to avail himself of the opportunity to shave with hot water, and to use the hot showers which were usually available. Recreational equipment and facilities were provided. Movies were often shown; reading and writing materials were at hand; and the patient was provided with cigarettes, candy, and personal items. Red Cross counselling and aid were available to soldiers with personal or family problems of a welfare nature. A chaplain was present for those who had felt

the lack of adequate contact with sources of religious support during combat.

**C. Psychotherapy**—**1. The patient-physician relationship, and the history-taking situation.**—It was found to be important that the psychiatrist combine with an attitude of respect and sympathy for the patient, the qualities of firmness, decisiveness, and realism. The aim was to allow no doubt to arise in the patient's mind that he would be expected to return to full duty when capable of doing so. The technic of history taking was very important, both in obtaining proper understanding of the case, and as therapy in itself. It was essential that the examiner hear the patient out, and that the patient feel that he had received a fair hearing. If physical complaints were present, the organ system involved was carefully examined. Above all, no matter what the pressure of the situation, the psychiatrist avoided giving the patient a "brush-off." On the other hand, leading questions were always avoided because these patients were highly suggestible.

**2. Ventilation.**—Hearing these patients out, and allowing them to ventilate their fears, hopes, and resentments often brought symptomatic relief. The amount of material ventilated was frequently extraordinary. While it was being produced the psychiatrist strove to remain passive. During the course of such "talking-out," it was occasionally possible for the patient to formulate and work through his problems with a minimal degree of direction by the psychiatrist.

**3. Support of super-ego.**—Loyalty, and sense of duty to his buddies were among the most important supports of the soldier in combat. Invocation and strengthening of these forces were found to be of value in helping the wavering soldier to endure. The psychiatrist did not hesitate in properly chosen cases to call on the soldier's loyalty to his buddies and immediate combat group, and to point out the implications of his duty to support and defend his family. Although many soldiers responded to this type of appeal, calls on the soldier's loyalty to larger groups—the nation or the Army—were relatively less effective.

**4. Suggestion.**—Avoidance of suggestion of illness was reflected in the organization and atmosphere of treatment stations, and in the attitudes and actions of the psychiatrists. As much care was adopted to avoid suggestion of serious psychiatric illness, as of physical illness. The appointments and atmosphere of a conventional hospital were avoided to the fullest possible extent and Army and division psychiatric treatment facilities were made as much like ordinary Army leave or rest centers as was consistent with their medical mission. Except during the coldest of winter months, most division and army psychiatric treatment facilities were installed in tents rather than buildings. Patients slept on folding canvas cots, rather than beds, and neither mattresses nor sheets were provided. Patients therefore

slept in no greater luxury than personnel in leave or rest centers. There were no nurses, and all necessary ward care was administered by enlisted male orderlies, wearing regular O. D. or fatigue uniforms, not the white hospital orderly uniform. Patients remained in regular uniform; pajamas and convalescent suits were not issued.

Patients remained ambulatory and were not waited on except in the uncommon instances in which physical disease or disturbed behavior clearly necessitated it. Patients served themselves in the "chow line" for all meals, and went without assistance to the latrine. They made their own beds and policed the ward around their beds. All patients assisted in the performance of light work about the hospital on request.

All possible steps were taken to foster the expectation of return to full combat duty after a brief rest. Application of this principle was most highly developed at those division psychiatric treatment facilities which were organized as Treatment and Rehabilitation Centers. These were nonmedical installations, unprotected by the Geneva Convention. Their chief function, aside from treatment of psychiatric battle casualties, was to give physical training and battle indoctrination to replacements and soldiers returning to duty at the front from hospitals.

Both division and army psychiatric treatment facilities moved their entire patient load with them during all forward moves, whenever this was practicable. This avoided unnecessary transfer of patients to rearward installations, and fostered in the minds of patients the impression that they were probable candidates for return to full duty.

The psychiatrist in his contact with the patient avoided suggestion of organic or psychiatric illness. He maintained an attitude of firm kindness, and avoided display of oversympathy and concern. In the opening phases of his examination, he generally concentrated on a realistic appraisal of the combat situation and the stresses to which the patient had been subject, rather than on the issue of illness. By patiently allowing the soldier to express himself without prompting, and by phrasing all questions in neutral terms, the examiner obtained a full and complete story of the present illness, uncomplicated by symptoms suggested by leading questions.

The psychiatrist also avoided unnecessary suggestion of illness by making organic diagnoses and rendering medical treatment as indicated, decisively. He avoided subjecting the patient to unnecessary referrals to others for special examinations, consultations, laboratory and x-ray work, and abstained from "passing the buck" by needlessly evacuating patients to rearward medical installations for diagnosis and treatment. It was repeatedly demonstrated that indecision, unnecessary referrals, unnecessary evacuations for "specialist opinion,"

and unnecessary special diagnostic procedures, firmly implanted the idea of illness in patients through suggestion, and by enhancing the secondary gain of illness. For the same reason, unnecessarily long stays in hospital were avoided, because to the patient they suggested continued and perhaps undiagnosed illness.

Not only was suggestion of illness avoided, but the positive suggestion was implanted that the patient was not seriously ill, that his symptoms would be alleviated, and that he would return to full combat duty. In the proper type of case, suggestion was used in an individual manner as a sharply directed tool, to eliminate specific hysterical symptoms. Direct suggestion was occasionally made, often accompanied by "laying on of hands" that a paraplegia would disappear, that a tic would cease, or that blindness would be replaced by normal vision. The symptom frequently vanished in a dramatic manner. Treatment confined to such suggestion did not significantly alter basic psychopathology. The symptom removed by pure suggestion often recurred, or was replaced after a short while by another hysterical symptom; or on removal of the symptom the patient might be flooded with anxiety.

Therefore, while direct suggestion was frequently employed in treatment of hysterical symptoms, it was usually combined with uncovering of amnestic material and abreaction, and manipulation of secondary gain. When properly combined with one or both of those tools, direct suggestion was therapeutically valuable. In general, any uncovering therapy that was not supplemented by positive direct suggestion, did not attain its full therapeutic possibilities.

5. *Uncovering therapy* in forward area military psychiatry was directed chiefly toward the recovery of repressed traumatic battlefield experiences. Such material was occasionally recovered in the course of ordinary therapeutic interviews as the result of firm suggestion by the psychiatrist that the patient would now be able to recall his forgotten experiences. In the event of such recovery of repressed material, there was frequently much simultaneous release of emotion (abreaction).

(a) *Uncovering therapy with intravenous barbiturates*.—In general, nonmanipulative uncovering techniques were too time-consuming to be feasible in the forward area situation, and reliance was placed chiefly on uncovering techniques using intravenous barbiturates ("narcosynthesis," "narcoanalysis") or hypnosis. In the European and Mediterranean Theaters, the techniques employed generally included the use of some type of narcosis (pentothal sodium, sodium amyta, or ether). In the Pacific Theater, particularly during the Okinawa campaign,

hypnosis induced without preliminary narcosis was considered the method of choice.<sup>8,9</sup>

The most commonly used technic in the Mediterranean and European Theaters employed preliminary injection of pentothal sodium. It was popularized by Grinker and Spiegel<sup>10</sup> as a result of their experiences in the Tunisian campaign, but had been extensively used and described before by others.<sup>11</sup> The technic varied somewhat from examiner to examiner. That which will be described here was developed and standardized in the Fifth and Seventh Army Psychiatric Centers.<sup>12</sup>

Whenever possible, a special tent or room was set up for the purpose. It was kept partially darkened and quiet during the treatment. Before treatment was begun, it was explained to the patient, and he was encouraged to expect improvement of his symptoms as the result of it. He was led to expect that in the course of the treatment he would imagine himself to be on the battlefield again, and that he would relive the forgotten experiences.

One-half gram of pentothal sodium, dissolved in 10 cc. of distilled water, was injected over the course of 4 or 5 minutes while the patient counted backwards from 100. Injection was terminated when counting became thoroughly confused or stopped. Recognizing the proper endpoint was a matter of experience. In general, between 0.15 and 0.4 gm. was injected. At the end of injection, the therapist strongly suggested that the patient was back on the battlefield at that point in time which the history had shown to represent the probable beginning of the amnesic episode. It was usually of value at the same time to simulate battlefield noises, such as the whistling of a shell, and to call out to the patient to take cover. At the 312th Station Hospital in France, special noisemaking apparatus was used for this purpose, but at most other installations such apparatus was considered neither necessary nor desirable.

In most cases, the patient now began to cower, exhibit startle reactions, and show other evidences of battlefield terror. He called out to others as if in combat and proceeded to re-enact the traumatic experiences. At the points of greatest trauma, the emotions of fear, rage, and grief were usually forcibly expressed, and tears appeared.

\* MARKET, O. U.: Report on psychiatric service during Okinawa campaign. Submitted to Surgeon, Tenth Army 1 July 1945.

\*\* KAPFMAN, M. R.: Report of neuropsychiatric observer in Okinawa operation. Submitted to the Surgeon, Pacific Ocean Area 16 May 1945.

\*\* GRINKER, R. E., and SPIEGEL, J. P.: War Neuroses in North Africa. The Josiah Macy, Jr. Foundation, New York, N. Y. 1943.

\*\* WILDF, J. F.: Narcosynthesis in treatment of war neuroses. Brit M J 2: 4-7, July 4, 1942.

<sup>12</sup>This technic was portrayed graphically in a sound movie U.S. Army Film FB 184. Psychiatrist Procedures in the Combat Area.

Ordinarily it was expedient for the therapist to remain passive at this point, allowing the patient to proceed serially through his battle experiences, without being hurried or prompted. During the re-enactment it was occasionally wise for the therapist to assume the conversational role of one of the patient's "buddies," or his sergeant, lieutenant, or battalion surgeon, or of several of these successively. It was necessary to be certain that the entire series of repressed traumatic events was covered systematically before the session was terminated. If, after the patient had been allowed to produce spontaneously for some time, amnesia gaps still remained, the therapist prompted their filling by the appropriate questions and stimuli. In order that the interview not be prematurely terminated after the narcotic effects of pentothal had worn off, the therapist occasionally introduced hypnotic suggestions and commands. By doing this, he was able to prolong the interview indefinitely at his discretion.

When all amnesic material had been recaptured, the patient was prepared for termination of the procedure by being told he was in a hospital, that he had remembered the forgotten events, and that he would recall them on awakening. He was assured that his symptoms would be improved. If his disposition to noncombat duty had been already determined, he was reassured regarding this. The patient was then awakened. Reassurance was repeated, and the recaptured amnesic material was reviewed. Although many patients resisted this repetition, it was found to be extremely important. If not gone through with, the material was frequently repressed again, insight lost, and symptomatology resumed partially or completely. The disappearance of such symptoms as tics and pareses was pointed out to the patient, and he was assured that they had disappeared permanently.

If all points were systematically covered in the original session, optimal results were usually obtained in one pentothal session, and no further sessions were required. In a small percent of patients, recapture of repressed material was not complete, or there were residual symptoms, and one or two further sessions were necessary. Relief of symptoms was usually striking. Not only were hysterical symptoms such as tics and pareses removed, but probably the most striking result was seen in relief of tension, anxiety, and retardation, and in restoration of self-confidence. After a successful session, the patient gave the impression of being a healthy rather than a sick person.

Certain other types of response were less frequently encountered:

- (1) In the most common variant, the patient's productions were entirely in the past tense. Often, but not always, this was accom-

panied by considerable emotion, and by appropriate gestures such as the avoidance of shells. A fair portion of such interviews were successful in recovering the amnesic material, and the therapeutic results were often satisfactory. If they were not, a second session on a subsequent day often produced a more successful dramatic reenactment, in the present tense.

(2) In another variant response, the entire session differed little from any other psychiatric interview. Little emotion was aroused, the story was recited in the past tense, and the amnesic material was usually not recovered. The patient addressed the physician as such during the interview, the typical subsequent amnesia for the session was lacking, and the therapeutic result was usually unsatisfactory.

(3) Occasionally all that was elicited was a silly, drunken response. Being of no therapeutic value, such sessions were rapidly terminated.

(4) The malingerer typically responded with negativism, refusing to cooperate, answer questions, or tell his story. Occasionally, he became echolalic. Fantastic responses and obvious volitional productions for the purpose of misleading the therapist were occasionally seen.

Uncovering therapy using pentothal was indicated in any battle-precipitated psychiatric disorder in which a period of amnesia existed for presumably traumatic battlefield events. It was indicated in nearly all battle-precipitated hysterias, with or without complete binding of anxiety. Results were almost certain to be satisfactory in patients with paralyses, parses, tics, gross tremors, and hemi-tremors.

In many extremely tense, retarded patients with anxiety states, a period of amnesia for battlefield events could be demonstrated, and in these the procedure was definitely indicated. Perhaps some of the most gratifying therapeutic results were obtained in these patients. The procedure was of little value when amnesic gaps were not present. When, however, instead of a definite amnesic gap, there was hazy or fragmentary recollection of a certain period on the battlefield, the therapeutic results were often quite satisfactory. Intravenous injection of pentothal was often of value in patients with an entirely mute panic state. In such patients, no narcoanalysis was performed; no attempt was made to recover amnesic material or precipitate a re-enactment. Instead, as the pentothal induced relaxation, ordinary conversational contact was established with the patient. This was usually successful in eliminating mutism.

Pentothal uncovering therapy was contraindicated in the severe anxiety states with panic and confusion (the pseudopsychotics). Such patients were "stuck" in their traumatic battlefield experiences.

and were in fact reenacting fragments of those experiences. With these patients, the first task of therapy was to re-establish contact and orientation. This was hindered by the administration of any sedative. In simple anxiety states of from mild to moderate degree pentothal interviews were not only unilluminating, but actually decreased tolerance to further battle stress.

(b) *Uncoupling therapy using hypnosis*.—Uncoupling technics in which the suggestible state was induced by hypnosis rather than by intravenous sedatives, were primarily used in the Pacific, particularly in the Okinawa campaign. Subsequent to induction of the dissociated state, the procedure differed little from that described for the pentothal interview.

(c) *Critique of manipulative uncoupling methods*.—Existing explanations of the mechanisms of narcoanalysis did not fully satisfy many combat psychiatrists. There was little doubt that recovery and reintegration into consciousness of repressed traumatic memories, and the abreaction attendant thereon, were of fundamental importance, but the influence of several other factors remained unevaluated—the influence of suggestion, and the impact of this dramatic procedure on the patient-physician relationship. The role of the intravenous sedative was not clearly defined. Much fundamental research was suggested by these questions, but was never undertaken.

6. *Reassurance*.—Because psychiatric patients in the combat area were easily convinced that they were seriously ill, either physically or psychiatrically, it was found to be extremely important that the physician reassure them decisively after proper physical examination, that they had no serious physical illness. Similarly, it was found to be important that the patient be reassured concerning the magnitude of his psychiatric disability. In appropriate cases it was stressed that the reaction was situational, that it would be short-lived, and that it had no relationship to insanity. The patient was told that there should be no permanent aftereffects, and that the reaction should have no effect on civilian adjustment, on ability to work effectively, or to make proper social and marital adjustments. In patients returning to full combat duty, it was found to be wise to reassure the patient that an episode of emotional decompensation was not necessarily incapacitating for further effective combat duty. In general, events and reactions were placed in their proper realistic proportions. Effective reassurance confined itself to presentation of facts, and avoided empty expressions of confidence.

7. *Explanation*.—Patients frequently derived great benefit from explanation of the cause of their symptoms. They were greatly aided by an understanding of what may be termed the normal battle reaction,

i. e., the normal psychologic and somatic symptom complex resulting from battle fear. In appropriate cases the therapist could demonstrate that the patient's symptoms did not deviate in any important respect from this normal reaction.

8. *Manipulation of secondary gain.*—It became quite apparent to combat psychiatrists in the course of the war that the secondary gain to a person with neurotic illness was important in causing and perpetuating psychiatric disabilities in the troops. Illness could remove a man from the danger of battle and place him in the safety and comfort of a medical department installation. It could eventually result in his permanent removal from combat, or even in his return to the United States and discharge from the Army. Illness paid off, while health resulted in continued exposure to danger and deprivation.

Psychiatrists came to recognize the importance of this factor of secondary gain, and undertook to neutralize it if possible, as part of the therapy. Thus as soon as it had been determined that a given patient would not be returned to combat duty, the patient was informed of the decision. He was given reason to believe that this disposition was firm and not subject to reversal. This achieved removal of tension and pressure which resulted from anticipation of possible return to combat and eliminated further unconscious striving for the secondary gain of the illness.

Occasionally, symptoms were greatly ameliorated following a firm disposition to full combat duty. Such symptomatic improvement appeared to result from the fact that, in the face of an irrevocable disposition to full combat duty, symptoms became a burden instead of providing gain. In a few cases, secondary gain was manipulated by delaying the patient's evacuation until certain specified symptoms had subsided. In these cases, it was made clear to the patient that he would be evacuated and reclassified to noncombat duty, but that this would not occur until certain symptoms had cleared. Similarly, it was sometimes worthwhile to point out to patients from noncombat organizations the possible change in status that might accrue from illness and hospitalization. Hospitalization of a noncombat soldier, appearance before medical boards, and assignment to replacement depots always entailed some slight possibility that in the course of the administrative procedures he might be assigned to combat duty. Pointing this out was frequently therapeutically valuable.

9. *Sedation.*—The sedation policy followed in Seventh and Fifth Armies in 1944-45 represented a crystallization of previous experience. All sedation prescriptions were individualized. Each patient was interviewed briefly for screening purposes on admission. Generally, patients who had been on the battlefield a few hours before

1944, 39 percent of the patients admitted to divisional psychiatric facilities were returned to combat duty. In the same period, 24 percent of the patients admitted to army psychiatric facilities were returned to full duty. The consolidated figure for both divisional and army facilities was 46 percent. During the period 1 January to 24 May 1945 the corresponding figures were: divisions, 53 percent; army, 43 percent; and consolidated return to duty rate, 63 percent.<sup>12</sup> During the action of the Tenth Army on Okinawa, 83.6 percent of all hospitalized psychiatric patients were returned to full duty during the "first phase" (through 7 May 1945), during the "second phase" (8 to 28 May 1945), 57.2 percent were returned to duty; and in the "third phase" (subsequent to 28 May 1945), 32.3 percent of the patients were returned to duty.<sup>13</sup> In the First Army, over its entire period of combat experience (June 1944 to May 1945), division and army psychiatric facilities returned 51 percent of all patients to full combat duty.<sup>14</sup>

None of these figures take into account those psychiatric patients who were returned to full duty from battalion aid stations. It has been estimated that at least 60 percent of all psychiatric patients were sent to full duty from this treatment level. Statistics regarding the percentage of neuropsychiatric patients returned to full combat duty from a given echelon or treatment station reflected not merely the quality of psychiatric treatment at that point, but also many other factors. For instance, if psychiatric screening and treatment were excellent in echelons forward of the given psychiatric treatment installation, the latter would receive a large proportion of cases fit only for further evacuation. Consequently, its return to duty rate would be low. Similarly, if the divisions supported by a given psychiatric treatment installation were old veteran organizations, a high percentage of patients reaching the installation would be "burned-out" veterans who could not be returned to combat. Under such circumstances, the return to duty rate would be lower than when the divisions supported were new, fresh divisions.

#### FOLLOW-UP STUDIES

The efficacy of forward area treatment methods, as measured by subsequent performance of patients on duty assignments, was studied

<sup>12</sup> LEWIS, A. O.: Final summary and critique of Seventh Army Psychiatric Service for Historical Report. Submitted to Surgeon Seventh Army, 7 July 1945.

<sup>13</sup> MARKET, O. B.: Report on psychiatric service during Okinawa campaign. Submitted to Surgeon Tenth Army, 1 July 1945.

<sup>14</sup> SCHAFFER, W. G.: Neuropsychiatric service of First United States Army in European campaign—1944 and 1945. Submitted to Office of Surgeon General, U. S. Army.

by Glass<sup>16</sup> and by Ludwig and Ranson.<sup>17</sup> The former showed that 48 percent of patients returned to full combat duty had performed effectively after such return to duty. The figures of Ludwig and Ranson were in essential agreement with this. Ludwig and Ranson also found that of the patients evacuated from army psychiatric treatment facilities to the base, and subsequently reassigned within the theater to non-combat jobs, 93 percent had performed satisfactorily or better. At the time of this follow-up (from 6 to 8 months after evacuation from Seventh Army), 86.6 percent of the evacuated patients had been assigned to duty in the theater in noncombat assignments. Only 4.2 percent had been rehospitalized before reaching a new assignment, and only 9.2 percent had been evacuated to the United States as patients.

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<sup>16</sup> GLASS, A. H. Quoted in Appendix I, Statistical Studies Bull U. S. Army M. Dept. (Supp.) pp 200-202 Nov. 1949.

<sup>17</sup> LUDWIG, A. O., and RANSON, S. W. Statistical follow up of effectiveness of treatment of combat-induced psychiatric casualties. I returns to full combat duty, II evacuations to base. MIL Surgeon 196: 51-62, Jan 1947 169-175, Feb 1947.

with diabetes who was still highly resistant after more than 5 years. In this particular patient, 3,000 to 5,000 units of insulin daily were required over extensive periods to achieve a reasonably good degree of diabetic control.

The term insulin resistance is applied when more than 300 units of insulin daily is required for the control of diabetes. Although we have no exact information as to the amount of insulin secreted by normal man, the best estimate places the amount at about 200 units a day. The literature contains reports of totally depancreatized persons<sup>4</sup> (usually for malignancy) in whom the post-operative insulin requirements ranged from 40 to 100 units. It is hardly tenable that a normal man produces only 40 units a day. The explanation of complete control of totally depancreatized persons with such minor amounts of insulin can be found in the examination of the case records, viz. a small amount of food was ingested and a profound state of cachexia existed. The more profound the cachexia, with its concomitant factors of undernutrition, malabsorption, malassimilation, and greatly reduced basal state, the more hypersensitive is the individual to even trivial amounts of insulin, as shown by Allen.<sup>5</sup> Since the normal person produces only a few hundred units a day, the hyporesponsive state cannot be predicated solely on a basis of quantitative insulin production or requirement. The most probable conception is that these persons produce some unknown substance, an antihormone or some insulin-neutralizing or insulin-destroying substance, and that this unknown substance, which is not normally present, is able to destroy relatively large amounts of exogenous insulin which normally are far beyond the ability of the human organism to produce.

No patient may be said to be wholly nonresponsive to insulin. Some patients with diabetes have died in coma; however, they probably would have been revived if larger amounts of insulin had been employed. There are several instances of recovery from diabetic coma with doses of 5,000 units a day. In one instance of recovery 10,000 units were employed.<sup>6</sup> It is believed that if treated heroically with enormous doses of insulin, all patients in coma probably would be revived. The rate at which insulin is destroyed in the body is in direct proportion to the size of the dose.<sup>7</sup> Although insulin resistance

\* RICKETTS, H. T., BARNESWICH, A., and KNOWLTON, E.: Effects of total pancreatectomy in patient with diabetes. *Am. J. Med.*, 1: 229-245, Sept 1946.

<sup>5</sup> ALLEY, F. M.: Treatment of diabetes with insulin. *J. A. M. A.* 81: 1320-1325 Oct 20, 1923.

<sup>6</sup> BACLIY, R.; CHAT, P.; PITTE, M.; and CHARDERLOT: Sur un cas de coma diabétique avec Insulino-résistance réduite par l'administration intraveineuse de 10,000 unités d'insuline. *Bull et mém Soc méd d'hôp de Paris* 62: 596-601, 1947.

<sup>7</sup> GREFLET, P. O.: Duration of insulin action. *Am. J. Physiol.* 129: 17-21, Apr 1940.

is not specifically confined to diabetes, nevertheless in nonresponsive patients diabetes obeys the same laws and principles as in ordinary diabetes. If insulin is omitted the patients go into coma; if excessive doses of insulin are employed, mild or severe reactions may occur; insulin requirement increases with intercurrent infections and also fluctuates with alterations in body weight just as in usual diabetes. The doses cited above are extreme instances. Some insulin-insensitive patients, reported in the literature, have required not more than from 500 to 900 units for good control, over periods of many months. Once insulin resistance is established there is an increasing demand up to a certain maximum point; a plateau-like level is finally reached and, after weeks or months, this is followed by a gradual reduction in insulin demand. Frequently, as in the case presented here, infection plays a very important role; in our patient an infectious process associated with a gangrenous extremity on two separate occasions called for an unusual increase in insulin demand.

This unusual refractoriness to insulin is characteristic of only a few other hormones except perhaps the parathyroid. Lisser and Shepardson<sup>10</sup> encountered unusual resistance to parathyroid extract in a patient with parathyroid tetany. Clinicians frequently encounter patients who, for some unexplainable reason, are not affected adversely by large (0.6 or 1.0 gram) doses of desiccated thyroid extract. Ability to tolerate larger doses without evidences of therapeutic hyperthyroidism is not recorded, except in a few rare instances in which failure of absorption from the intestinal tract is evident. To assume that a person is resistant or hyporesponsive to the thyroid hormone would mean that he required or could tolerate as much as from 200 to 300 grains of thyroid extract in 24 hours in order to control clinical manifestation of myxedema. No such peculiarly resistant situation has been reported to date. There are a few reports of resistance to estrogenic substances or to desoxyorticosterone acetate.

Insulin resistance is not to be confused with certain states associated with temporary increases of insulin requirement. In diabetic acidosis there is a temporary increase in insulin demand. Uncontrolled diabetes, improperly balanced diets, high-fat diets, high-carbohydrate diets, and high-calorie diets require relatively large doses of insulin, but these are explainable. There is a temporary increase in insulin requirement in the presence of infections; the requirement increases as the infection increases, but this rarely exceeds a few hundred units over a brief period of time and subsides quickly as the infection dimin-

<sup>10</sup> Lissner, H., and Shepardson, H. C. Further and final report on case of tetany parathyreopexia, treated for year with parathyroid extract (collip), with eventual death and autopsy. *Endocrinology* 13: 427-454, Sept.-Oct. 1929.

sions. There is no relationship between the duration of diabetes, the severity of the disease, the type of insulin, or the previous state of diabetic control. We know very little about the action of insulin although it has been in use for almost 30 years.

*Biochemical function of insulin.*—It has been long recognized that glucose utilization and oxidation are not entirely dependent on the action of insulin. The part played by the hormone in these physiologic actions is still in doubt. The importance of insulin in making possible carbohydrate storage in the form of glycogen and fat was first stressed by Drury<sup>14</sup> and Pauls and Drury.<sup>15</sup> This work has been amply confirmed by isotope tracer studies.<sup>16</sup> Beyond the fact of carbohydrate storage, principally as fat, there is little agreement concerning the over-all action of insulin. The biochemical details of this storage function are not known. Probably the first step in the utilization of glucose for any purpose is the formation of glucose-6-phosphate under the influence of the enzyme hexokinase. The recent articles by Cori and his coworkers<sup>17,18</sup> suggested that the action of insulin was hexokinase action, if not actively, by removing the inhibition of the anterior pituitary or adrenal cortex hormones. However, Stadie and Haugaard,<sup>19</sup> Mirsky and Broh-Kahn,<sup>20</sup> and others have failed to show any alteration of the hexokinase reaction in muscle or kidney extracts from diabetic rats when compared with normal controls. It is very probable that insulin is concerned with the early phase of glucose oxidation. The normal blood pyruvate response obtained on administration of glucose is absent in the depancreatized dog or patient with diabetes unless insulin is given simultaneously.<sup>21,22</sup> Recent work from this laboratory involving the administration of radioactive carbon-labeled glucose with and without insulin, to eviscerated rabbits, indicates that insulin accelerates the formation of a

<sup>14</sup> DRURY D R. Role of insulin in carbohydrate metabolism. *Am J Physiol* 131: 526-543 Dec 1940.

<sup>15</sup> PAULS F and DRURY D R. Influence of insulin upon glycogen storage in diabetic rats. *J Biol Chem* 113: 451-455 Oct 1942.

<sup>16</sup> STETTER, DEW JR and FOOTE, O E. Studies in carbohydrate metabolism: metabolic defects in alloxan diabetes. *J Biol Chem* 156: 271-278 Nov 1944.

<sup>17</sup> COLOWICK S P, CORI G T, and SIEGMUND M W. Effect of adrenal cortex and anterior pituitary extracts and insulin on hexokinase reaction. *J Biol Chem* 165: 543-546 May 1947.

<sup>18</sup> PRICE, W H; CORI C F and COLOWICK, S. P. Effect of anterior pituitary extract and of insulin on hexokinase reaction. *J Biol Chem* 160: 673-674 Oct 1943.

<sup>19</sup> STADIE W C and HAUGAARD, N. Hexokinase reaction in tissue extracts from normal and diabetic rats. *J Biol Chem* 177: 311-324 Jan 1949.

<sup>20</sup> MIRSKY, I A and BROH-KAHN, R H. Hexokinase activity and diabetes mellitus. *Selener* 166: 148-149 Aug 15 1947.

<sup>21</sup> REEDING E, FRIEKA, J F.; HERRELLICH, H.; and HILDEBRANDT, H E. Effect of insulin on pyruvic acid formation in depancreatized dogs. *J Biol Chem* 148: 97-104 Apr 1942.

<sup>22</sup> LIDINGER, I; WORTIS R; FERIN H D; and FETTERMAN, D. Pyruvic acid metabolism in diabetes mellitus. *Am J Med Sc*, 244: 638-645, Dec. 1942.

water-soluble metabolite. Further work is being carried out on these studies.

*Absorption of insulin.*—A consideration of the failure of absorption of insulin from the site of injection is important; however, we have no data that lead us to believe that absorption of insulin in the hypo-responsive patient is any different from that in the usual patient with diabetes. Insulin is administered in a watery solution and readily permeates all tissues. Insulin-resistant persons are equally resistant to large amounts of intravenously administered or subcutaneously injected insulin. Root et al.<sup>23</sup> in 1944 showed that there was a minor delay in absorption of radioactive insulin in resistant individuals as compared with controls, but there was nothing to suggest failure in total quantitative absorption. Furthermore, we now question the chemical composition of the material used and assumed to be radioactive insulin.

*Excessive loss of insulin in the urine.*—In the early years following the discovery of insulin one of the explanations for insulin resistance pertained to undue loss of insulin through the urine. With improvements in insulin assay methods and more complete study, we now know that the amount of insulin lost in the urine is negligible in normal, diabetic, and hyporesponsive patients. Very little is known about the excretion of the end products of insulin in the urine, if any. Mirsky et al.<sup>24</sup> demonstrated that the average daily excretion of urinary insulin was only 0.04 units per day in normal persons and 0.03 units in diabetic persons; also that mere minute fractions of very large amounts of injected insulin were excreted by either subject. Insulin-resistant patients ordinarily excrete no more insulin than normal persons and when injected with very large amounts of exogenous insulin show no increase in urinary output. This leads to the assumption that insulin is destroyed in the human body.

*Allergy.*—Local sensitivity to insulin in such forms as wheals, urticaria, painful nodules at the site of injection, or lipodystrophy<sup>25</sup> is not to be confused with hyporesponsiveness or insulin resistance. However, about 10 percent of the insulin-resistant patients did exhibit local allergic manifestations to insulin. The use of highly purified forms of insulin and recrystallized insulin in several instances has not brought about a decrease in demand for insulin or served to make

<sup>23</sup> Root, H. F., and others: Absorption of insulin labelled with radioactive iodine in human diabetes. J. A. M. A. 121: 54-59 Jan 8, 1944.

<sup>24</sup> Mirsky, I. A., et al.: Urinary excretion of insulin by normal and diabetic subjects. J. Clin. Investigation 27: 515-519, July 1948.

<sup>25</sup> Oestreich, D. L., and Watson, E. M.: Insulin fat atrophy. Am. J. M. Sc. 218: 172-178, Aug 1949.

patients any less resistant. There are many references in the literature citing the coexistence of local skin reaction and temporary increases in insulin requirement in which it is concluded that the patients were allergic to insulin. Full supporting evidence, however, is not sufficient to be convincing. Allan and Scherer<sup>2</sup> in 1933 presented the findings of a 55-year-old woman with diabetes who showed urticaria and wheals, whose insulin requirement was moderately excessive. It was assumed that the resistance was of an allergic character. She had many complications—acidosis, Hodgkin sarcoma, and coronary heart disease, which today would be considered as factors in increasing the insulin requirement rather than to assume that some allergic factor was responsible.

In all probability, local sensitivity and allergic reactions result from impurities in commercial insulin. Because insulin is a protein it might easily be contaminated with other proteins or split products of questionable nature. Too little attention has been paid to the actual purity of insulin, and in some important articles on the immunization of animals against insulin the question of the purity of the insulin used as an antigen has been overlooked. Recently Jorpes<sup>3</sup> has shown that allergic reactions were universally eradicated by the use of insulin that had been purified by recrystallization. Three hundred diabetic patients who showed localized or generalized reactions became symptom-free when insulin which had been recrystallized from three to five times was substituted for the ordinary commercial product.

*Immunity to insulin.*—In 1935 Banting et al<sup>4</sup> published a report of a nondiabetic schizophrenic patient who built up a remarkable increase in tolerance to insulin exceeding 1,000 units during the course of insulin shock therapy. The initial treatment with 20 units of regular insulin reduced the blood sugar level to 0.080 mg per 100 cc, whereas after 59 treatments there was very little reduction in the blood sugar level with 1,000 units of insulin. An immune reaction was discussed as a likely possibility.

In view of the size and complexity of the insulin molecule, some degree of antibody formation might occur. Although the molecule contains nine or more amino acids and 3.2 percent sulfur, we cannot assume that it is antigenic. It is further illogical to consider that a substance which is present as a normal part of the organism should be physiologically antagonistic to the same organism. If it were

<sup>2</sup> ALLAN F. S. and SCHERER, L. R. Insulin resistance due to allergy, with report of case. *Am. J. M. Sc.* 165: 515-521 June 1933.

<sup>3</sup> JORPES J. E. Recrystallized insulin for diabetic patients with insulin allergy. *Arch. Int. Med.* 33: 763-771 Apr 1949.

<sup>4</sup> BANTING F. G., FRASER W. E., and GILBERT S. Anti-insulin activity of serum of insulin treated patient. *Am. J. Psychiat.* 93: 562, 1936.

capable of producing antibodies we would expect to encounter three instances of insulin resistance in more than 1 million persons with diabetes in America: we would also anticipate varying degrees of insulin resistance. That insulin is a poor antibody producer is very clearly shown by Leeman.<sup>3</sup> She failed to produce any hypersensitivity in rabbits or guinea pigs who received 5 units of insulin subcutaneously or intraperitoneally. The population test was used as a measure. However, it failed to show that the serum from insulin-treated animals offered any protection to the normal animal against minimal lethal doses of insulin. Examination of the blood from 1 insulin-resistant patients failed to show insulin antibodies or passive transfer antibodies.

Lovell<sup>4</sup> presented a method for demonstrating neutralization of insulin in mice by serum obtained from a insulin-resistant subjects. The presence of the insulin-neutralizing antibody was assumed to be indicative of the degree of resistance to insulin. He concluded that insulin resistance may occur at an immunological basis and under certain circumstances the antibody exhibited species specificity. He differentiated between the insulin-cross-reacting antibodies and anti-insulinizing antibodies. The same author<sup>5</sup> also reported the production of insulin resistance in guinea following the repeated injections of a mixture of heat-killed yeast-like organisms of *Candida* fungiformis. The results were not very uniform or very striking so the specific antigenicity of insulin is questioned. Since it is essential to evaluate the results of hyperinsulinism to insulin in experimental animals especially mice. There are great variations individually. There is also a difference in insulin tolerance for various classes of transplants. Third, have a relatively higher incidence than humans. Thus at the Hollingshead's census of vital statistics of the Territory of Connecticut only for 20 brother-sister generations and was able to produce insulin-resistant strains on the basis of heredity. Some strains were as much as 20 times as resistant as others. Once a resistant strain was produced there was no difference in sex or weight.

The third factor of obesity is the fourth factor of insulin action — Because some of the previously mentioned mechanisms—immunity, failure of sympathetic activity, excessive loss of insulin in the urine, or

<sup>3</sup> LEEMAN, S.: Insulin tolerance test of normal rat by methods. Ann. N.Y. Acad. Sci., Vol. 194.

<sup>4</sup> LOVELL, F. C.: Immune response of a antibody to insulin in mice. Proc. Soc. Exptl. Biol. & Med. 87: 250-252. Oct. 1954.

<sup>5</sup> LOVELL, F. C. and PELTIER, W.: Insulin cross reactions in the rat. J. Exptl. Medicine 94: 238-246. Sept. 1951.

<sup>6</sup> LEYER, E. T., KREMER, H. C., LINDNER, G. and TUNNEY, J. L.: High insulin tolerance in normal strains of mice. Proc. Soc. Exptl. Biol. Med. 92: 245-248. Sept. 1952.



# Carcinoma of the Prostate

JAMES C KIMBROUGH, Colonel, MC, U. S. A.<sup>1</sup>

**I**N THE 10-year period ending 31 December 1949, 435 patients were operated on for benign prostatic hypertrophy in this hospital.

In the same decade, 78 patients were treated for carcinoma of the prostate, a total of 513 patients with prostatic enlargement (table 1).

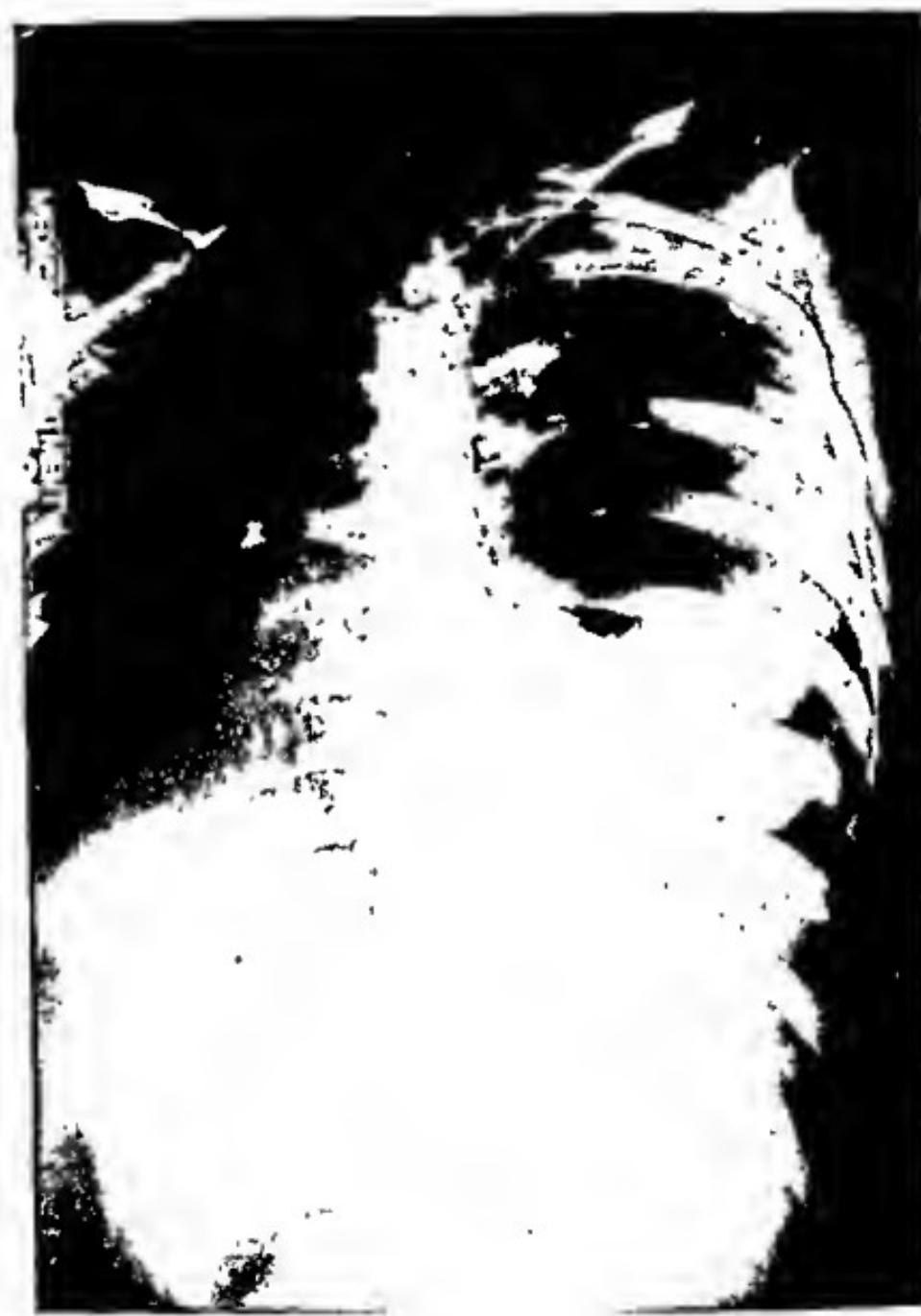
TABLE 1.—Number of patients with prostatic enlargement in 10-year period

Year	Patients with benign hypertrophy	Patients with carcinoma	Total	Percent with carcinoma	Patients treated by perineal prostatectomy	Percent of patients with carcinoma treated by prostatectomy
1940	42	10	52	19.2	1	10
1941	49	3	52	5.7	0	0
1942	22	4	23	12.2	0	0
1943	32	4	36	11.1	1	25
1944	26	4	30	13.3	2	50
1945	41	2	43	4.9	2	100
1946	50	7	57	12.3	3	42.9
1947	50	18	68	26.5	13	72.9
1948	59	14	73	19.2	9	64.3
1949	57	12	69	17.4	8	66.7
Total	435	78	513	15.2	39	76

**Treatment.**—Radical perineal prostatectomy was performed in 39 (50 percent) of the patients with carcinoma. In the remaining 50 percent the carcinomatous process had spread by local extension or by metastases beyond the limits of surgical eradication; these received only palliative treatment. Important advances have been made in the palliative treatment of carcinoma of the prostate. Although the life of the patient has been prolonged and made more comfortable, the only cure is complete surgical eradication of the cancerous process, which is possible only if the malignancy is detected before spread beyond the limits of the prostate gland has occurred.

**Diagnosis.**—Digital rectal examination is the most important procedure in early diagnosis. Pain, dysuria, and other subjective symptoms appear too late in the course of the disease for surgical cure, and

<sup>1</sup> Walter Reed Army Hospital, Washington, D. C.



*Figure 1.—Preoperative roentgenogram.*

**Operation**—The patient was anesthetized with pentothal sodium and curare intravenously plus nitrous oxide and oxygen intratracheally. The blood pressure became unobtainable and blood was administered by forced pressure, using the three-way stopcock technique. The patient rallied and the abdomen was entered through a left upper rectus muscle-splitting incision. Large quantities of blood

and blood clots were evacuated from the peritoneal cavity. There was a radial tear in the left diaphragm extending from the esophageal hiatus almost to the periphery. The stomach, spleen, and left lobe of the liver were reduced from the chest and inserted. There were two small insignificant lacerations of the liver. The ruptured and bleeding spleen was removed and the vessels were ligated with silk. Blood clots and blood were evacuated from the left pleural cavity, in which the lung was completely collapsed. The diaphragm was repaired with a series of interrupted through-and-through silk sutures. Further exploration revealed a hematoma in the left kidney region. The posterior peritoneum was incised, exposing a lacerated and bleeding left kidney. The kidney was removed and the vessels and ureter were ligated with silk; the posterior peritoneum was then closed with a continuous suture. The abdominal incision was closed in layers without drainage and the left phrenic nerve was exposed through a low cervical incision and crushed with a hemostat. The patient received 2,500 cc. of blood during the procedure.

**Diagnosis.**—Traumatic rupture of the diaphragm, spleen, and left kidney.

**Pathological report.**—The spleen measured 12 by 5 by 4 cm. and weighed 290 grams. The capsule was smooth and thin and the tissue firm. At the hilus and anterior margin there was a large jagged "bursting" type of laceration measuring 5 cm. through which hemorrhaged mass of splenic pulp and blood clot protruded. On section, the remainder of the splenic tissue appeared normal.

The left kidney measured 10.5 by 6 by 3 cm. and weighed 145 grams. The capsule had been stripped and the surface was smooth. A jagged linear rupture line extended through the upper pole into the hilus, almost completely separating the upper pole from the rest of the kidney. The pelvis and stump of ureter appeared normal.

**Postoperative treatment and course.**—The patient was returned to the ward in good condition and placed in an oxygen tent. Continuous gastric suction through a Levin tube was begun and the legs were wrapped with elastic bandages. Another 500 cc. of blood were administered, and the patient was given penicillin, prednisone, fluids parenterally, vitamins, and protein hydrolysate. The pulse and blood pressure remained stable, but there was some cyanosis and dyspnea; a roentgenogram demonstrated complete collapse of the left lung. A thoracotomy was performed in the left seventh interspace and a 14F catheter was inserted and connected to a Watergeren suction apparatus.

The patient's condition was satisfactory on the first postoperative day. The left lung was completely re-expended and the thoracotomy tube was removed. The patient was able to take deep breaths, exercise and to exercise the legs regularly; the elastic bandages were removed.

On the second postoperative day the red blood cell count, urine, blood urea nitrogen, serum protein, and chloride were all normal. The 24-hour urinary output was 2,675 cc. and the temperature 98.6° F.

On the third postoperative day peristalsis was active and the gastric suction was discontinued. Fluids were given by mouth. The clips were removed from the neck incision. Oxygen was discontinued.

The remainder of the postoperative course was uneventful except for thoracocentesis two days later to remove some amber fluid from the left pleural space. A chest roentgenogram (fig. 2) on 10 April 1949 was normal except for a slight elevation of the left diaphragm. On 11 April 1949 the patient left an convalescent home, entirely asymptomatic. She returned to duty 1 month later.



# Empyema In Infancy

JAMES A. DUCETT, *Captain, MC, A. U. S.<sup>1</sup>*  
JOHN T. BOWERS, *First Lieutenant, MC, A. U. S.<sup>2</sup>*

THE treatment of empyema in infants and children was primarily surgical prior to the advent of penicillin therapy. Numerous methods of draining the empyema cavity had been tried but uniformly poor results were obtained, particularly in infants under 2 years of age. This situation has been greatly improved, first with the advent of sulfonamide therapy in conjunction with repeated thoracentesis, and later, and more dramatically, with penicillin. The case presented here demonstrates what can be expected from early institution of adequate penicillin therapy in conjunction with repeated thoracentesis in those patients harboring a penicillin-sensitive organism.

## CASE REPORT

A 7-week-old white female infant was admitted to this hospital on 9 March 1950. Her parents reported that she had had a cold, manifested by cough, low-grade fever, and a serous nasal discharge, for about 2 weeks prior to admission. About 24 hours prior to admission, she developed respiratory distress with dyspnea and cyanosis that persisted to the time of admission.

Physical examination on admission revealed a moribund, poorly nourished and poorly developed white female infant with cyanosis and respiratory distress. The respirations were shallow and tachypneic and respiratory excursions were definitely limited on the left side. Tachypnea with frequent episodes of apnea were noted. There was slight inflammation of the pharynx. The tympanic membranes were normal. Examination of the chest revealed flatness to percussion over the entire left side of the chest, with absent breath sounds over the same area. The trachea was displaced to the right. The heart sounds were distant, of poor quality, and there was tachycardia. The abdomen was distended with gas but no masses or organs were palpable. The rectal temperature was 100.2° F. The patient weighed 8 pounds 6 ounces.

The leukocyte count was 12,800, with 45 percent polymorphonuclear cells, 54 percent lymphocytes, and 1 percent monocytes. The erythrocyte count was 2,910,000 with 10 grams of hemoglobin. Throat culture taken at the time of admission yielded hemolytic *Staphylococcus aureus*.

A roentgenogram of the chest (fig. 1) at the time of admission showed complete obliteration of the left pleural space by fluid, with displacement of the trachea and mediastinum to the right, consistent with the clinical diagnosis of massive empyema of the left side of the chest. Slight improvement occurred

<sup>1</sup>U. S. Army Hospital, Fort Hamilton, Brooklyn, N. Y.



Figure 1.—Roentgenogram at time of admission, showing massive empyema of the left side of chest and shift of the trachea and mediastinum to the right.

after oxygen was administered. A thoracentesis was performed; 107 cc of yellow-green purulent material was slowly withdrawn and 75,000 units of penicillin dissolved in 3 cc of normal saline solution was introduced into the pleural space. A stain of the material removed showed gram-positive cocci. A pure culture of hemolytic *Staph. aureus* was recovered.

On removal of the purulent fluid from the left pleural cavity, the infant's general appearance immediately improved. She became less cyanotic, the respiratory distress decreased, the trachea shifted toward the midline, and breath sounds were again audible over the left side of the chest. A postthoracentesis roentgenogram of the chest (fig 2) showed an area of increased density in the left periphery overlying the scapula. The infant was given 100,000 units of crystalline penicillin intramuscularly every 3 hours. On the second hospital day the left pleural space was again aspirated; 20 cc of purulent material was obtained and 100,000 units of penicillin was injected into the pleural space. Culture of the aspirated material yielded no growth. The leukocyte count was



Figure 2.—Roentgenogram following initial pleural aspiration, showing clearing of the left lung field and return of the trachea and mediastinum toward the midline.

7.0%, with 21 percent polymorphonuclear cells, 76 percent lymphocytes, and 3 percent monocytes. The infant's condition was much improved; there was no cyanosis, the respiratory rate was normal, the respirations were regular and equal bilaterally, and the temperature was normal.

On the third hospital day, thoracentesis was again attempted but no pus was obtained. Transfusions of whole blood were given on the third and fifth hospital days. There was no further cyanosis or dyspnea and the physical examination was essentially normal. The infant's appetite improved. A roentgenogram of the chest (fig. 3) was taken on the fifth hospital day, and fluoroscopy confirmed the belief that the density previously described in the left periphery was caused by pleural thickening.

The course thereafter was entirely satisfactory. The temperature remained normal, the appetite improved, and the weight increased. On the eighteenth hospital day the dose of penicillin was reduced to 100,000 units every 6 hours, and on the thirty-third hospital day the drug was discontinued. The infant was

discharged on the thirty-fifth hospital day. Her weight at the time of discharge was 10 pounds 1 ounce. A roentgenogram taken 34 days after the initiation of therapy (fig. 4) showed the lung fields to be completely clear.

#### DISCUSSION

Empyema in infancy and childhood occurs most often as a complication of pneumonia. Prior to the advent of sulfonamide and penicil-



Figure 3.—Roentgenogram taken on fifth hospital day.

lin therapy, the pneumococci were the most common causative agents. Next in order of frequency were the hemolytic streptococci, *Staph. aureus*, and rarely the influenza, typhoid, Friedländer, and colon bacilli.<sup>2</sup> Adequate therapy of pneumonia with sulfonamides and/or

<sup>2</sup> LANMAN, T. H. and HEYL, H. L.: Empyema in children. New England J. Med. 221, 1003-1009, Dec. 28, 1939.

penicillin has greatly reduced the incidence of empyema, particularly those forms caused by pneumococci and hemolytic streptococci.<sup>4</sup>

Prior to penicillin therapy, the age of the patient was an important factor in determining the mortality from this disease, with the high case-fatality rates occurring in infants under 2 years of age, and decreasing as the age of the child increased.<sup>4</sup> Thus, Lanman and



*Figure 4.—Roentgenogram showing essentially normal chest.*

Dimmeler,<sup>5</sup> reporting a series of 467 children with empyema, found the case-fatality rate among those under 2 years of age to be about twice

<sup>4</sup> NELSON, W. E.: Mitchell-Nelson Textbook of Pediatrics. 5th edition. W. B. Saunders Co., Philadelphia, Pa., 1950, pp. 1011-1015.

<sup>5</sup> PENBRETH, G. C. and BENSON, C. D.: Management and treatment of empyema in children. *Am. J. Surg.* 39: 267-274, Feb., 1939.

<sup>6</sup> LANMAN, T. H., and DOUCETT, C. L., JR.: Management of acute empyema in children. *Am. J. Surg.* 51: 29-34, Oct. 1941.



Figure 1.—Preoperative view showing extent of the radicular cyst in the right mandible.

were vital. Roentgenograms of the lateral and anterior-posterior extraoral aspects of the right mandible revealed a large area of radiolucency extending from the mesial root of the second molar to the symphysis of the mandible (figs. 2A and 2B) which had caused definite



Figure 2A.—Preoperative roentgenogram of radicular cyst in the right mandible.



Figure 2B.—Preoperative roentgenogram of radicular cyst in the right mandible.

expansion and thinning of the bone on the superior and lateral borders. A diagnosis of radicular cyst was made and the patient was prepared for operation.

#### *Operation*

*Oral surgical procedure.*—Under intratracheal anesthesia with nasal intubation, an incision was made at the lower border of the mandible, extending from the angle to the symphysis. Two percent procaine hydrochloride with epinephrine was infiltrated locally for hemostasis. The soft tissues were reflected upward and the entire buccal plate of the mandible was exposed. The cyst, about the size of a hen's egg, was excised en masse. Hemostasis was secured by gelfoam at the bleeding points in the bony cavity. The cystic contents were examined by the pathologist and found to be sterile. A cancellous bone graft was taken from the left iliac crest, divided into chips, and gently packed in the bony cavity. The soft tissues were sutured over the

defect and a pressure dressing was applied. A drain was inserted to prevent the formation of a hematoma.



Figure 3.—Postoperative view. The jaw is firmly healed and there is no evidence of recurrence of the cyst.



Figure 4.—Postoperative roentgenogram 5 months later shows healing and consolidation of bone chips.

*Procedure in elevating bone graft.*—An incision was made over the crest of the left ilium. The soft tissues were elevated and retracted and the periosteum was stripped from the bone. The cortical plate of bone at the iliac crest was chiseled off, and a portion of the cancellous bone was chiseled out of the bed. This cancellous bone was divided into chips about the size of half a pea. The periosteum and soft tissues were sutured back in apposition.

*Postoperative course.*—The mandible was immobilized with Ivy loops and intermaxillary elastics to restrict the mandibular movements in order not to displace the bone graft by muscular activity. Penicillin, a liquid diet, and moderate sedation for pain were prescribed. The patient noted paresthesia of his lower lip and chin, which was to be expected after an operation of this sort; otherwise the postoperative course was uneventful. On the sixth postoperative day, the sutures were removed. The incision healed by primary intent (fig. 3). Periodic roentgenograms were taken, and by the fifth postoperative month, the bone chips appeared completely homogeneous and viable (fig. 4). The paresthesia of the lower lip persisted for 3 months, after which all sensation was normal. Soon after the operation, vitality tests of the molar and bicuspid teeth, whose roots were exposed in the cyst, were negative, but by the end of the second postoperative month they gave positive responses to cold, heat, electricity, and the bur, so they were not extracted.

## MANAGEMENT OF LABOR

When labor had become definitely established, as evidenced by the quality and frequency of the uterine contractions and the progressive dilatation and effacement of the cervix, the patient received an initial dose of 100 mg. of demerol and 0.6 mg. of scopolamine. The timing of this initial dose depended on the stoicism and the pain threshold of the individual patient. Generally, primiparas received this medication when their pains were of good quality, occurred as often as every 3 minutes, and the cervix was dilated 4 cm. The timing of the administration of demerol and scopolamine to multiparas depended on parity, history of rapidity of previous labors, strength and frequency of labor pains, dilatability of the cervix, and, above all, the experience and clinical judgment of the attending obstetrician. In both primiparas and multiparas, if labor was still active 1 hour after the administration of the first analgesic, 100 mg. of demerol were given and repeated thereafter at 1- to 2-hour intervals, depending on the progress of labor. Scopolamine was seldom repeated after the initial dose.

Caudal analgesia was induced in primiparas when the cervix was nearly or fully dilated and the vertex in a normal anterior position. In multiparas caudal analgesia was induced when the cervix was dilated, 6 to 8 cm., depending on the activity of labor and the position of the presenting part.

## TECHNIC OF CAUDAL ANALGESIA

The malleable needle technic with 1.5 percent metycaine as the anesthetic agent was used for caudal analgesia. Several innovations

not previously described were also applied. Figure 1 shows a readily constructed wooden stand to hold the caudal tray and figure 2, the tray at the patient's bedside. Figures 3 and 4 show a caudal roll that was used to keep the patient's weight off her abdomen while lying prone to facilitate insertion of the caudal needle.

After inserting the malleable needle, careful aspiration determined that the subdural space had not been entered. Eight cubic centimeters of the metycaine solution was then injected and in 5 minutes, if there was no paralysis of the lower extremities and again

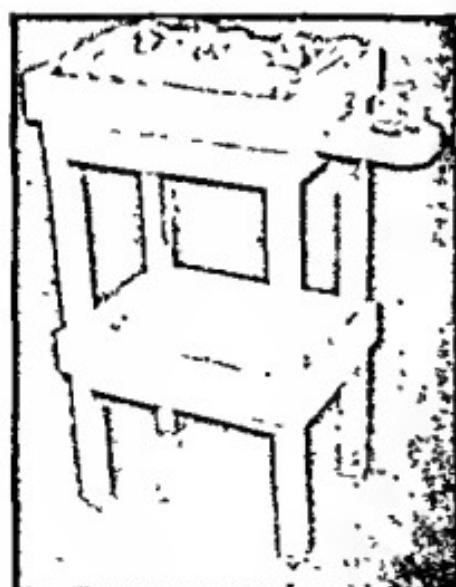


Figure 1.—Caudal tray stand.

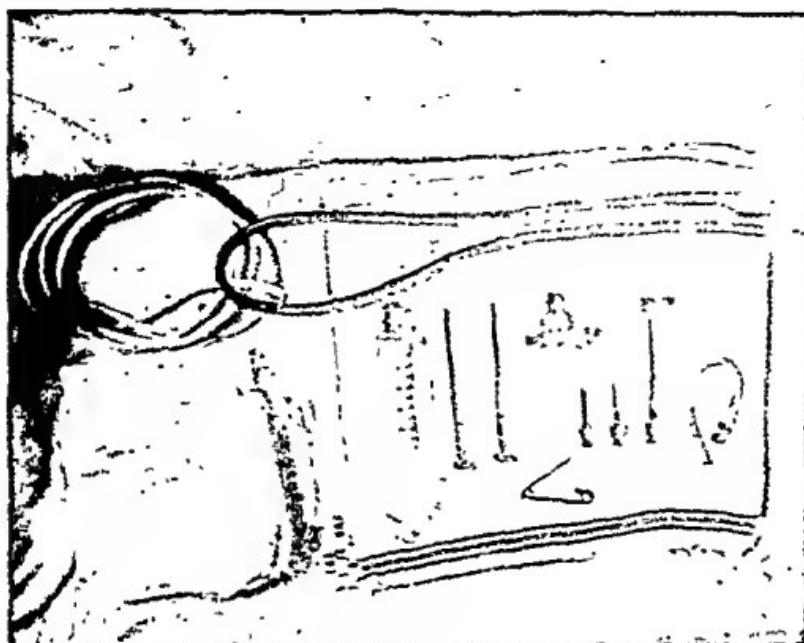


Figure 2.—Caudal tray.

after careful aspiration, the remaining 22 cc. of the initial 30 cc. dose was injected. If by then the head was visible and the patient was judged to be ready for delivery, the caudal needle was removed and the patient was placed on the delivery table. If the patient was not ready for delivery, the continuous caudal analgesia apparatus was connected as described by Lundy.<sup>10</sup> Further doses of 20 cc. of the metycaine solution were administered every 30 to 45 minutes according to the level of anesthesia as determined by pin-prick (the optimum level of anesthesia was at the umbilicus) and the patient's subjective complaint of returning pain. The average total amount of 1.5 percent metycaine administered to primiparas was 50 cc. and to multiparas, 46 cc. The average duration of the caudal analgesia, as measured from the time of the first injection of metycaine until



Figure 3.—Caudal roll (length 18 inches, diameter 6 inches).

<sup>10</sup>LUNDY, J. S.: Continuous caudal anesthesia in obstetrics. *S. Clin. North America* 23: 541-557, Aug. 1943.

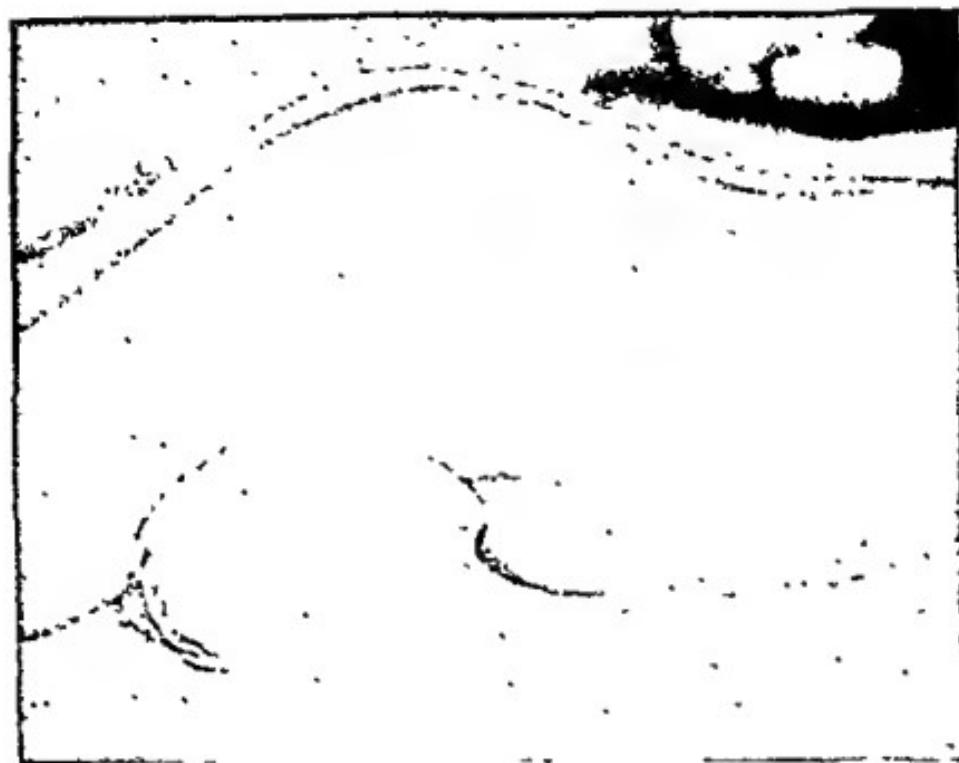


Figure 4.—Patient on caudal roll.

completion of the delivery (including any repair necessary), was 1 hour and 15 minutes for primiparas and 56 minutes for multiparas.

Careful check on maternal blood pressure and fetal heart rate was kept throughout labor. If there was a decided fall in blood pressure, 50 mg. of ephedrine was administered and the patient's lower extremities were raised for autotransfusion.

#### RESULTS

Of the 700 consecutive patients delivered, 320 were primiparas and 380 were multiparas. The average lengths of the various stages of labor were shorter than those given in the standard textbooks of obstetrics (table 1). Maintaining demerol and scopolamine analgesia closer to the time of delivery before administering the caudal analgesic resulted in 51 percent spontaneous deliveries (table 2) as compared to 39.2 percent spontaneous deliveries reported by Nicodemus et al.<sup>1</sup> In an effort to reduce the incidence of persistent occiput posterior presentation, 43.3 percent of the patients in this series were examined vaginally in order to determine accurately the position of the presenting part prior to administering the caudal analgesic. If anterior rotation had not occurred, the patient was given every opportunity to accomplish this prior to inducing caudal analgesia. In the

report of Nicodemus et al., 10.6 percent of the patients required forceps or manual rotations as compared to 6.3 percent in our series.

TABLE 1.—*Parity and average duration of labor*

	Number of patients <sup>1</sup>	First stage	Second stage	Third stage
Primiparas.....	320	9 hr 23 min	1 hr 30 min ..	23 min
Multiparas.....	380	5 hr 51 min ..	51 2 min ..	26 min
Total.....	700			

<sup>1</sup> Infants, 704 (4 sets of twins).

TABLE 2.—*Type of delivery and obstetrical operation*

	Number	Percent of total		Number	Percent of total
Spontaneous .....	359	51.0	Forceps rotation		
Low forceps.....	235	40.5	Posterior	9	1.3
Mid forceps.....	23	3.5	Transverse	6	.8
Persistent occiput posterior .....	46	6.5	Breech-fundal pressure	22	3.1
Deep transverse arrest.....	18	2.5	Breech extraction	5	.7
Manual rotation					
Posterior.....	35	5.0			
Transverse.....	12	1.7			

TABLE 3.—*Maternal complications*

	Number	Percent of total		Number	Percent of total
Infection (pyelitis, phlebitis, and endometritis) ...	17	2.40	Required retention catheter	51	7.30
Maternal death .....	1	1.4	Postpartum hemorrhage	9	1.28
Required catheterization .....	220	31.40	Fall in blood pressure requiring ephedrine	0	1.28

### COMPLICATIONS

The maternal complications that occurred in this series are noted in table 3. Despite the high incidence of vaginal examinations during labor, mild infection occurred in only 2.4 percent; this is not excessively high. Most of these manifested themselves as phlebitis or pyelitis; and there were no serious cases of endometritis. The single maternal death occurred in a patient who developed phlegmasia alba dolens and died suddenly at home 3 weeks postpartum. Although there was no postmortem examination, it seemed probable that the cause of death was pulmonary embolism.

The only annoying complication was postpartum urinary retention; 7.3 percent of the patients required a retention catheter for the relief of this condition. It was found that the incidence of this complication could be lowered by careful postpartum observation of the patient's bladder to insure that it did not become overdistended prior

to the return of the urge to void. Thirty-one and four-tenths percent of the patients required postpartum catheterization to prevent overdistension of their bladders.

The low incidence of postpartum hemorrhage (blood loss of 500 cc. or over) confirmed the observations of others of this advantage of delivery under caudal analgesia. Only 9 patients had a fall in blood pressure sufficient to require the administration of ephedrine and no maternal or fetal difficulty was attributable to these transient hypotensions.

There were no cases of postpartum headache, infections at the site of insertion of the caudal needle, neuropathies, or other maternal complications.

#### FETAL MORTALITY

One of the great advantages of conduction anesthesia for delivery is evident in the fact that 93.42 percent (table 4) of the infants cried spontaneously at birth. The fact that there were only 7 stillborns and 10 neonatal deaths was also remarkable. Two of the stillborns weighed less than 1,500 grams (table 5) and, therefore, were in the so-called preivable weight group. One of the stillborns was a macerated premature infant weighing 1,530 grams at birth, whose mother was admitted to the hospital with diabetic acidosis. The remaining 4 were full-term infants, one macerated and the other 3 dying during labor from undetermined causes.

TABLE 4.—Condition of newborn infants

	Number	Percent of total
Apathetic at birth	41	6.1
Spontaneous cry	624	93.4
Stillbirths	7	1.0
Neonatal deaths	10	1.4

TABLE 5.—Stillborn infants

Term	4
Prematures (1,500-2,500 grams)	1
Preivable (less than 1,500 grams)	2
Congenital abnormalities	0
Total	7

Four of the ten neonatal deaths (table 6) were due to congenital abnormalities incompatible with life (two had congenital heart disease, one had spina bifida, and one had congenital cystic kidneys). One of the ten weighed 1,000 grams and would, therefore, fall in the preivable weight group. Five of the ten neonatal deaths were prema-

tive infants. The only full-term infant born alive who died and did not have a congenital abnormality definitely incompatible with life weighed 3,820 grams at birth and died 14 hours later. Autopsy revealed congenital ptelrethia.

TABLE 6 *Neonatal deaths*

Term	4
Premature	5
Preatable	1
Total	10

\* 4 congenital abnormalities (3 term and 1 premature).

There were 41 premature infants weighing between 1,500 and 2,500 grams, an incidence of prematurity of 5.82 percent in this series. Thirty-five of these premature infants were born alive and survived and six of them were either stillborn or died neonatally, giving a gross fetal mortality rate of 14.63 percent. One of the six premature infants who failed to survive was the stillborn macerated infant born to the mother admitted with diabetic ketoacidosis; another premature infant died of congenital cystic kidneys, previously mentioned, and the remaining four prematures died neonatally—one from cerebral hemorrhage and three from undetermined causes.

#### RESULTS OF ANALGESIA

The same observer questioned each one of the 700 patients within 48 hours of their delivery. How the patient felt about the success of her analgesic is shown in table 7.

TABLE 7 *Results of analgesia*

Result	Primiparous		Multiparous	
	Number	Percent of total	Number	Percent of total
Precaudal				
Ideal	201	62.8	187	49.2
Good	80	15.6	63	16.6
Poor	26	18.4	50	21.6
Failure	10	3.1	60	10.6
Caudal				
Ideal	211	92.2	317	83.4
Good	5	3.3	6	1.5
Poor	8	2.6	13	3.4
Failure	12	3.7	40	11.6

*Precaudal analgesia.*—If the patient remembered nothing of her labor shortly after the first injection of demerol and scopolamine, the result was classed as ideal. If she remembered very little or believed that the injections relieved a great deal of her pain, the result was classed as good. If she admitted to little relief from her precaudal

analgesia, the result was classed as poor, and if she received no relief or time did not permit the precaudal analgesia to become effective, the result was classed as a failure. The main causes for the poor results and failures in this series were: (a) lack of time for the demerol and scopolamine to become effective because labor was too far advanced when the patient was admitted to the hospital or because of too rapid progress of labor; and (b) inexperience of the obstetrician in the correct timing of the administration of the drugs. The patients of the senior members of the group consistently reported better results than did those of the younger members.

*Caudal analgesia.*—If the patient received complete relief from pain shortly after administration of the caudal analgesia, the result was classed as ideal. If the patient recalled slight pain during delivery but the accoucheur believed the caudal analgesia was effective, the result was classed as good. If relief from pain was incomplete or one-sided as evidenced by the patient's reactions during labor but still no supplementary anesthesia was required for delivery, the result was classed as poor. If the caudal analgesia did not relieve the pain of uterine contractions or delivery or if for any reason caudal analgesia was not attempted, the result was classed as a failure. The most frequent cause of unsuccessful caudal analgesia (table 8) was insufficient time for its administration—often the patient entered the hospital ready for delivery or the progress of labor was misjudged. In only 12 cases was it impossible to insert the malleable needle into the caudal canal. Recognized bony abnormality of the sacrum was the cause of four of these failures and thick fat pads over the sacrum caused two. The cause of the other six failures was undetermined. In 28 patients, although the operator believed that the caudal needle was accurately placed in the caudal canal, satisfactory pain relief was not obtained and the reason for these unsuccessful caudal analgesias could not be determined.

TABLE 8.—Reasons for unsuccessful caudal analgesia

Reason	Fried- paras	Mul- tiparous	Reason	Fried- paras	Mul- tiparous
to time	—	14	Adiposity over sacrum	—	2
above misjudged	—	9	Bony abnormality of sacrum	—	2
unable to insert needle—cause unknown	2	—	Patient's request not to have caudal analgesia	—	1
expulsion of blood	—	6	Labor failed to progress after inducing caudal analgesia	—	1
operation of spinal fluid	1	—	Inducing caudal analgesia	—	—
menstrual cyst	—	1	Cause undetermined	11	17

#### SUMMARY

In 1943 the results of 500 deliveries under continuous caudal analgesia at the George F. Geisinger Memorial Hospital were reported

and it was concluded that labors were longer, occiput posteriors rotated less often, and operative deliveries were increased. As a follow-up, 700 consecutive vaginal deliveries occurring in the same closed staff institution from 1 July 1948 to 15 March 1949, were studied in an effort to discover what change had evolved in the management of labor to remedy the few handicaps of this method of analgesia.

In this series, demerol and scopolamine were used to induce analgesia in the first stage of labor, making it possible to administer caudal analgesia late in the first stage or in the second stage of labor. Labors were shorter, the incidence of forceps deliveries was reduced, and the incidence of persistent occiput posterior positions requiring rotation was reduced. Postpartum urinary retention requiring retention catheters in 7.3 percent of the patients was the most annoying maternal complication in this series. Maternal morbidity was low despite the high incidence of vaginal examinations during labor. The incidence of postpartum hemorrhage was unusually low. The single maternal death occurred at home 3 weeks postpartum and was probably due to a pulmonary embolus. Ninety-three percent of the infants cried spontaneously at birth. The gross still birth rate was 1 percent and the gross neonatal death rate was 1.4 percent, giving a gross or uncorrected fetal mortality rate of 2.4 percent.

The incidence of premature births was 5.83 percent and the gross fetal mortality rate for premature infants was 14.63 percent.

Seventy-eight and five-tenths percent of the primiparas and 66 percent of the multiparas received ideal or good relief from the demerol and scopolamine analgesia. Caudal analgesia was successful in 94 percent of the primiparas and 85 percent of the multiparas.

#### CONCLUSIONS

By the use of demerol and scopolamine analgesia in the first stage of labor, the caudal analgesic may be administered closer to the time of delivery resulting in: (a) shorter labors; (b) lower incidence of operative deliveries; and (c) lower incidence of persistent occiput posterior positions.

Demerol-scopolamine-caudal analgesia in the hands of a group clinic of trained obstetricians is a safe and effective method of inducing analgesia as evidenced by: (a) spontaneous crying at birth of 93 percent of the infants; (b) a gross or uncorrected fetal mortality rate of 2.4 percent; and (c) successful caudal analgesia in 89 percent of this series of 700 consecutive vaginal deliveries without maternal mortality or injury attributable to the analgesic.

in gastrointestinal operations has been a challenge to all general surgeons. Heavy bacterial implantation into surgically traumatized tissue throws an added handicap on the repair mechanism, which is now required not only to bridge the gap established, but also to eliminate the invading bacteria and their deleterious effects. Failure to obtain gastrointestinal sterilization has been a major deterrent in the progress of surgery in this field. Good technical performance has often met with defeat because of infection occurring in suture lines, mural abscess, resultant leakage, and peritonitis. This complication is still the most common single cause of failure in gastrointestinal operations. To meet this challenge several chemotherapeutic agents have been employed with gratifying results.

Prior to the availability of chemotherapeutic agents, preparation for intestinal operations was almost entirely dependent on starvation and elimination. These principles are still valid in that an empty bowel is usually at physiologic rest and has a significantly reduced bacterial content. Enemas and mild catharsis, when indicated, remain initial steps in preparing the patient for operation. Today although parenteral therapy is available for amelioration of starvation, intestinal antiseptics aid and implement mechanical cleansing.

The effectiveness of any agent used in bowel sterilization is dependent on several factors, namely (a) the antibacterial spectrum of the

### FACTORS INFLUENCING INTESTINAL ANTISEPSIS

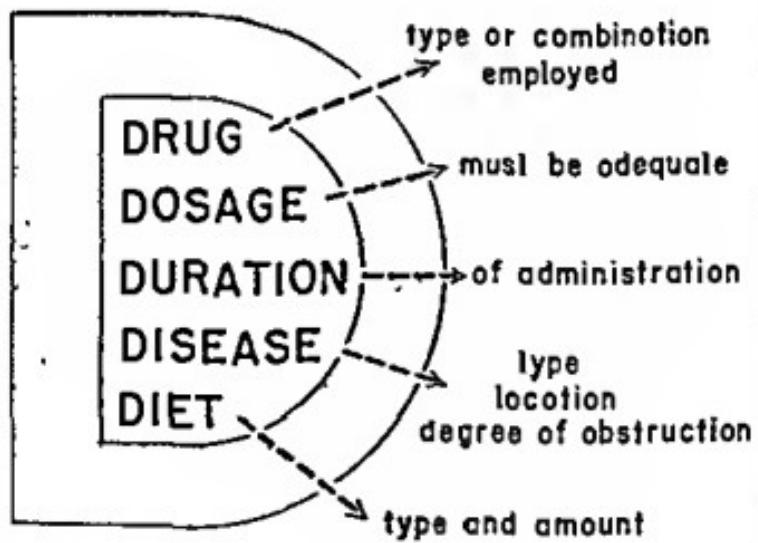


Figure 1.

drug, (b) the dosage employed, (c) the duration of its administration required for optimal bacteriostasis, (d) the rapidity of emergence of drug-fast bacteria, (e) the quantity of bacteria-laden food ingested, (f) the incidence of drug idiosyncrasy or toxicity, and (g) the presence of obstruction or nonsterilizable surfaces (fig. 1).

Largely as the result of investigations by Poth<sup>1</sup> the nonabsorbable sulfonamides, sulfasuxidine and sulfathaladine, became accepted as effective drugs in establishing and maintaining a 99 percent elimination of susceptible fecal flora. Their advantages lay in their being poorly absorbed from the intestinal lumen and the low incidence of untoward effects. Although adequate doses of these agents may alter the aerobic flora for periods as long as 6 weeks, it was shown that these agents had no appreciable effect on enterococci, pseudomonas, or proteus organisms.<sup>2</sup> Since the advent of sulfonamide prophylaxis, procedures previously accomplished in two or more stages are now commonly replaced by single-stage primary anastomosis accompanied by a greater sense of security, and with commendable success.

Since 1945, Reimann et al.<sup>3</sup> and Zintel et al.<sup>4</sup> have shown streptomycin orally to be much more effective than sulfonamides against coliform bacteria and enterococci. This drug is nonirritating and, because it is not readily absorbed, is retained in the bowel in relatively high concentration. The coliform organisms are greatly reduced in 48 to 60 hours and suppression can be maintained for 5 to 8 days. Within this time, however, drug-resistant strains appear, causing the total bacterial count to rise to normal in the face of continued therapy. For this reason Lockwood et al.<sup>5</sup> warned that the preoperative use of this antibiotic alone may be dangerous because of the risk of a peritonitis caused by drug-resistant flora following operation. Preoperative oral administration of streptomycin for longer than 3 days is now considered injudicious. Poth et al.<sup>6</sup> and Lockwood showed that no synergistic action accrued when streptomycin was used in combination with sulfathaladine.

<sup>1</sup>POTH, E. J.: Sulfonamides as therapeutic agents in intestinal antisepsis: collective review. *Internat Abstr Surg* 78: 373-380, 1944. In *Surg Gynec & Obst* May 1944.

<sup>2</sup>POTH, W. M.: Intestinal antisepsis with sulfonamides. *Ann Surg* 113: 829-832, May 1942.

<sup>3</sup>REIMANN, H. A.; ELINS, W. P.; and PATER, A. H.: Streptomycin for typhoid-pharmaco-cholesterol study. *J. A. M. A.* 128: 173-180, May 19, 1945.

<sup>4</sup>ZINTEL, H. A.; WILBY, M.; NICHOLS, A. C., and RHODES, J. E.: Use of streptomycin in surgical patients. *Surgery* 21: 175-183, Feb. 1947.

<sup>5</sup>LOCKWOOD, J. S., ET AL.: Appraisal of oral streptomycin as an intestinal antiseptic with observations on rapid development of resistance of *Esch. coli* to streptomycin. *Ann Surg* 129: 14-21, Jan. 1949.

<sup>6</sup>POTH, E. J.; McNUTT, P.; MANHOFF, J., JR.; KING, B.; and SINCLAIR, G.: Healing of bowel as influenced by sulfasuxidine and streptomycin. *Surg Gynec & Obst.* 86: 641-646, June 1948.

The superiority of streptomycin in effecting rapid reduction of the fecal bacterial count stimulated search for a supplemental agent to block emergence of dangerous drug-resistant bacteria. Pectin compounds give subjective relief in patients with various diarrheas. This effect is believed to be caused by the metabolism and the liberation of a uronic acid radical. Metallic pectinates have been shown to be bacteriostatic independent of their low pH values.\* Streptomycin, when used in combination with aluminum pectinate, has proved to be more effective in the suppression of bacterial flora than when used alone. Not only are the coliform organisms rapidly reduced in numbers, but gram-positive organisms such as the hemolytic streptococcus and clostridia are also suppressed. Experience has demonstrated, however, that the large doses of pectinate required to accomplish this may result in a feeling of fullness and bloating. Moreover, at operation the intestine contains much gelatinous residuum, a condition less desirable than a flat, empty bowel.

Glucurono-lactone, a derivative of glucuronic acid, has been shown to be more effective than the pectin compounds when employed with streptomycin for this purpose.\*\* Glucuronic acid is conjugated in the liver and is considered to be the principal agent by which various drugs are detoxified. The combination of streptomycin and glucurono-lactone employed is not accompanied by undesirable side effects and produces pronounced suppression of predominating bacteria in 48 to 60 hours. Fecal antisepsis may be maintained for comparatively long periods. On discontinuing the drug, a normal flora does not reappear before 48 hours. Furthermore, streptomycin-resistant strains do not seem to predominate in this new growth.

The newer antibiotics, aureomycin and chloramphenicol, exert an effect on intestinal bacteria intermediate between that of the sulfonamides and streptomycin. In contrast both are readily absorbed. Aureomycin by mouth has been advocated for the surgical preparation of the bowel by several authorities. A recent publication of the Mayo Clinic<sup>11</sup> concludes: "Aureomycin is the most effective substance we have found for removing bacteria from the intestinal tract of man." Polaski<sup>12</sup> in a prior study demonstrated that although significant reduction in the flora did occur, it was "of lesser magnitude than

\* WOOLRIDGE W E. and BLAST, G W. Effects of uronic acids; pectins and pectinates on the enteric flora, alone and in combination with antibiotics; *In vitro* studies. *Am J Surg* 58: 841-856 Dec 1948

\*\* PRASIKI, E. J. and COVELL, J. F. JR. Control of peritoneal infection in gastrointestinal surgery. *Bull U S Army M Dept* 9: 263-270, Apr 1949

<sup>11</sup> DRAZING W H and HIRSHMAN, F R. The effect of aureomycin on the bacterial flora of the intestinal tract of man: a contribution to preoperative preparation. *Proc Staff Meet Mayo Clin* 25: 87-102, Feb 15 1950.

that obtained from sulfonamides or streptomycin<sup>1</sup> and therefore of questionable value. Subsequently, Metzger and Shaper<sup>2</sup> duplicated this work and obtained results in close agreement with those of Polkoff.<sup>1</sup> They further demonstrated that with streptomycin a definite overgrowth of proteus organisms occurred, coincident with the coliform suppression, to such an extent that "the total gram-negative count in the weighed stool far exceeded the normal count." Acne-  
cycline therefore still has to be proved a superior agent in the establishment and maintenance of intestinal antisepsis. In addition, it is expensive.

Chloramphenicol, like streptomycin, causes *E. coli* to disappear gradually. The total bacterial count falls and then rises, with *E. coli* as the predominant organism. After initial suppression has terminated, the bacterial counts tend to rise above pretreatment levels and remain high, decreasing only after the drug has been discontinued. It therefore possesses no unique features as a preoperative intestinal antibiotic. Like streptomycin presently, it is a comparatively expensive drug.

The action of polymyxin is qualitatively similar to that of streptomycin except that drug failure apparently does not occur and gram-negative and gram-positive organisms are eradicated. Likewise, it is not absorbed from the gastrointestinal tract. Further evaluation of this drug is necessary. At present, polymyxin is commercially unavailable.

No single drug or combination of drugs may be considered ideal. Each has appreciable effectiveness, even its limitations. From animal laboratory evaluation and clinical experience two types of drugs appear to be superior to others: (1) The transferable sulphonamides in doses of 600 to 750 grams per kilogram of body weight for 5 days are reasonably effective if it is possible to prepare specimens for this length of time. They are also economical and usually readily available; (2) an experienced with oral will over 100 patients, has demonstrated the superiority of 2 grams of streptomycin and 4 grams of gluconeo-galactose daily for this purpose. This combination more effectively reduces the total intestinal bacterial count, does it quickly, maintains suppression for comparatively long periods, and is not handicapped by the development of a drug-resistant form.

In preparing a patient for elective gastrointestinal surgery, it is essential for the maximal effect of any drug that the tract be cleared of its contents and maintained that way. This implies enemas

<sup>1</sup> MELVIN, W. L. and STERK, J. Evaluation of oral streptomycin for intestinal antisepsis. *J. Amer. Med. Assn.* 192: 1020, 1964.

and/or enemas until the bowel is emptied and permitting nothing but liquids by mouth in this period of management. This allows for mass reduction in bacterial content and maximal contact between the agent and remaining micro-organisms.

In preparing for an emergency operation in a patient with luminal or vascular obstruction or perforation from any cause such a leisurely approach is not permissible. Decompression is urgently needed to prevent further spread of infection and to combat the associated ileus. Early surgical repair or exteriorization is mandatory, with parenteral antibiotics as one supportive measure. The use of antibiotics by the oral route in these patients or following an elective operation which has become complicated by peritonitis, is ineffectual. Polybacterial peritoneal soilage may be extensive. The immediate establishment of a high antibiotic blood level, and, therefore, peritoneal exudate level, is a surer means of inhibiting further bacterial invasion or multiplication. Scientific proof is lacking in support of the value of sulfonamides or antibiotics placed in the peritoneal cavity. Shock, dehydration, secondary anemia, hypoproteinemia, and electrolyte disturbance receive proper daily attention. The gastrointestinal tract must be placed at rest and so maintained until all points of leakage have sealed, and the peritoneal soilage is being adequately managed by the natural defenses of the body. This is usually signaled by return of peristalsis, normal pulse, reduction of fever, passage of gas or feces voluntarily, and reduced abdominal rigidity and sensitivity. Parenteral antibiotics are continued until these signs are evident for at least 48 hours.

The lethal organisms in peritonitis are gram positive. The antibiotic most effectively employed against these organisms is penicillin, but since it is readily inactivated by penicillinase, which is elaborated by fecal gram-negative organisms, the use of penicillin alone in mixed infections is inadequate. Streptomycin with its known specificity for combating the gram-negative organisms, when parenterally administered with penicillin, may be expected to give adequate coverage in these cases. In severe peritoneal infections, the addition of parenterally administered sulfadiazine may be desirable for synergistic effects.

Recently parenteral aureomycin has been demonstrated to be of real value in combating secondary peritonitis. Wright et al<sup>12</sup> reporting on aureomycin treatment of a series of 52 consecutive patients with peritonitis secondary to perforated peptic ulcer, appendicitis, and diverticulitis, with a mortality of only 4 percent, concluded that this drug is of significant value. Certainly with increased availability,

<sup>12</sup> WRIGHT, F. T. et al. Treatment of acute peritonitis with aureomycin. *Am. J. Surg.* 78: 17-22, July 1949.

aureomycin deserves serious consideration in combating this complication. Further experience is necessary to establish its position in our armamentarium. Aureomycin-glycinate in doses of 500 mg. with 1,000,000 units of penicillin G given intravenously every 12 hours in 1,000 cc. of physiologic saline solution has given gratifying results in fulminating infections in our 6-month test period. The most singly effective agent to date in our hands is terramycin, of which we administer 1 gram intravenously every 12 hours.





# The Superior Vena Caval Syndrome

## Report of Two Cases

G. MARION KAHN, *Commander, MC, U. S. N.*<sup>1</sup>

**I**N THE past 3 years two cases of the superior vena caval syndrome have been observed by the author. Both of these were a result of new growths and the patients were seen too late for remedial measures to be successful.

Unfortunately facilities were not available to do diodrast studies, and bronchoscopic examinations were not made because the first patient was too seriously ill and the second patient failed to stay in the hospital for this procedure. However, autopsies performed on both patients confirmed the clinical impression of new growths with invasion of the superior vena cava.

In a comprehensive survey of the literature in 1949, McIntire and Sykes<sup>2</sup> studied all cases reported from 1901 up to and including January 1946. They found 250 authentic cases and added 2 more of their own. They stated that Fischer<sup>3</sup> had collected 252 cases of this syndrome prior to 1901.

The incidence, anatomic and physiologic considerations, etiology, symptoms, treatment, prognosis, and historical data are most adequately covered in the articles by McIntire and Sykes and by Hussey et al.<sup>4</sup>

A search of the literature available at this hospital and in this area has failed to reveal any additional published articles dealing with the superior vena caval syndrome between 1946 and May of 1950.

<sup>1</sup>U. S. Naval Hospital, San Diego, Calif.

<sup>2</sup>MCINTIRE, P. T., and SYKES, E. M., Jr.: Obstruction of superior vena cava; review of literature and report of two personal cases. *Ann. Int. Med.* 30: 025-050, May 1949.

<sup>3</sup>FISCHER, J.: Über Verengung und Verschließung der Vena cava superior. *Inaug. Dissert.*, Halle, 1901. Cited in<sup>2</sup>.

<sup>4</sup>HUSSEY, H. H.; KATZ, S., and YATES, W. M.: Superior vena caval syndrome: report of 35 cases. *Am. Heart J.* 31: 1-26, Jan. 1946.

## CASE REPORTS

CASE 1. A 67-year-old white man was admitted to the U. S. Naval Hospital, San Diego, Calif., on 11 December 1947 complaining of shortness of breath for 4 years, cough for 2 years, chest pain and orthopnea for 4 months, swollen arms and face for 2 months, enlarged veins of chest and abdomen for 6 weeks, loss of appetite for several months, and hemoptysis for 2 weeks. A review of former admissions revealed (1) that in 1945 he was believed to have cardiac asthma and he had roentgenographic evidence of distinct passive congestion for which he was treated with iodides and sulfonamides; and (2) that in 1946 when roentgenograms of the chest were essentially negative (fig. 1) but he was complaining of shortness of breath and difficulty in breathing when lying down he was believed to have bronchitis and discharged after a short stay in the hospital.

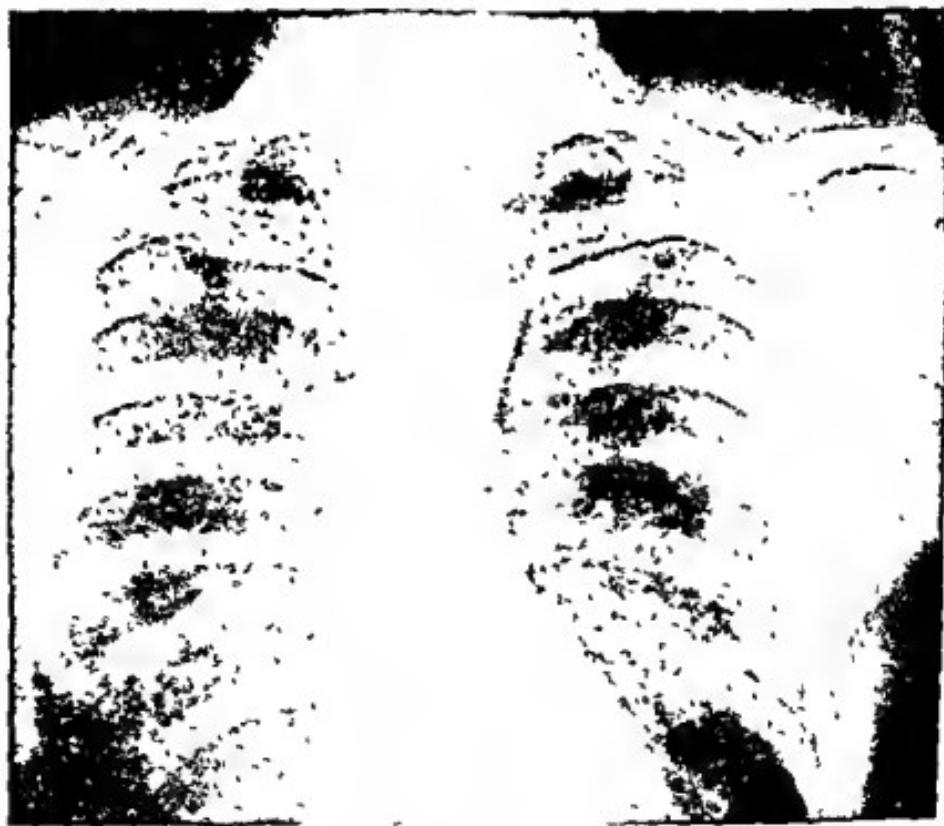


Figure 1.—Case 1. Roentgenogram taken 15 October 1946.

The physical examination on this admission revealed an elderly white male with moderate cyanosis who appeared to be in acute distress. He was unable to breathe except when in the upright position. There was minimal cervical and inguinal adenopathy with marked bilateral axillary adenopathy, and an extensive network of distended

veins over the thorax and abdomen; the arms were edematous. There was increased dullness to percussion to the right and left of the sternum, dullness in both bases with a few sibilant rales, and a fluid mass was palpable just below the xiphoid cartilage.

*Laboratory data.*—The urinalysis was negative; sedimentation rate, 25 (Cutler); hemogram, normal; blood Kahn test, negative; serum proteins, 6.2 grams with A/G ratio of 1/1. The electrocardiogram was normal. Roentgenograms of the chest (figs. 2 and 3) revealed widening of the upper mediastinum; it was irregular along the right border and there was a moderate amount of fluid in the right pleural cavity and a suggestion of some fluid in the left base. There was moderate aortic calcification.

Indirect laryngoscopy revealed paralysis of the interarytenoid muscle.

*Venous pressures and decholin studies.*—(a) Patient was almost upright; (b) decholin time, 26 seconds; (c) venous pressure, 300 mm. water; (d) no essential change in venous pressure on deep inspiration

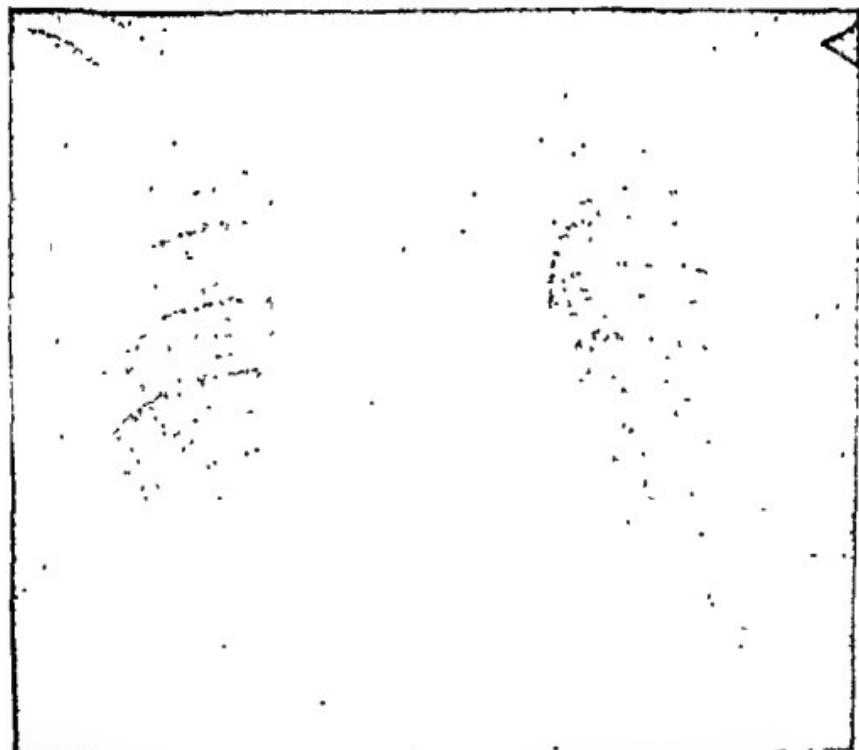


Figure 2.—Case 1. Roentgenogram taken 20 December 1947, 14 months following the first roentgenogram. This and figure 3 show the widening of the mediastinum.

this area into the right apex and a slight increase in the bronchovascular markings radiating downward from this region.

The vital capacity was 3.21 against a normal of 4.90 liters. Specimens of sputum stained by Papanicolaou technic were negative for malignant cells. Gastrointestinal barium study was negative. Laryngoscopic examination was negative. Barium enema was negative. Fluoroscopic examination of the chest revealed both diaphragms to



Figure 4—Case 2. First roentgenogram of chest taken 19 September 1949 revealing the infiltration extending up into the right apex.

move freely. The electroencephalogram was normal. An infra-red photograph of the chest (fig. 6) showed dilated veins in the upper chest. Cystoscopic and retrograde urinary tract studies were negative.

A roentgenogram of the chest taken 5 weeks after the first one revealed a slight increase in the infiltration in the upper right lung field and it was noted that there was a small patch at the periphery of the left lung opposite the second interspace anteriorly.

The patient was digitalized and preparations were made to perform a bronchoscopy, however he insisted on leaving the hospital against medical advice. At the time of discharge the pulse was 84, the chest was hyperresonant with coarse moist rales in the right lung, the liver was 3 fingerbreadths below the costal margin, there was

clubbing of the fingers, and 4 plus pitting edema of the legs up to the knees.

Approximately 4 weeks after discharge he was readmitted complaining of shortness of breath and edema of the upper extremities. The physical examination revealed an acutely ill white male who was extremely dyspneic and cyanotic. The blood pressure was 100/60. The heart was enlarged to percussion 2 cm. outside the midclavicular



Figure 5.—Case 2. Roentgenogram taken 10 October 1949, 21 days after figure 4, showing increase in density extending into right apex.

line in the fifth interspace, there was marked dullness with decreased breath sounds and vocal fremitus over the lower one-third of the right lung, the liver was palpable 2 fingerbreadths below the costal margin, there was slight nonpitting edema of both legs, and 3 plus pitting edema of both upper extremities. A roentgenogram taken just prior to death showed the right pleural cavity almost completely filled with fluid. Despite all supportive measures he died 24 hours after admission.

*Postmortem findings.*—There was replacement of the intercostal muscle in the fifth intercostal space by necrotic pink tumor with ero-

## PRINCIPLE 4

A removable partial denture should not injure remaining teeth or adjacent structures. It is essential to plan or design the restoration in accordance with biologic laws governing the reactions of tissue. Sound principles of mechanics must also be followed in order that the appliance will function without undue alteration. The appliance must be carefully made so that it will go into its place without modification of the adjacent structures. The casts used in making removable partial dentures must be made from impressions which faithfully record the shape of the oral tissues.

The functions of a removable partial denture are: (a) the restoration and preservation of occlusion impaired by loss of teeth; (b) the restoration and preservation of occlusion impaired by malposition of remaining teeth; (c) the preservation of the remaining teeth and alveolar ridges; and (d) the restoration of a normal or desirable facial expression impaired by loss of teeth or closure of the bite. A removable partial denture must be planned and constructed to fulfill these essential purposes with a minimum of interference with the tongue or enunciation and the least possible display of structural materials. The various parts of the base must be designed to provide an adequate mechanical counterbalance or resistance to the differently directed forces or movements without interfering with any of the functions of a removable partial denture.

Saddles are supporting elements, one of their functions being to resist vertical masticatory pressure against the alveolar ridges. These flanges, resting against the lingual or labial sides of alveolar ridges, may provide bracing support against horizontal, lateral, or anteroposterior displacements. The stress of mastication must be resisted by an adequate support. When possible, toothborne support should be used, otherwise the size of the saddle must be increased in proportion to the stress exerted on it. When the size of the saddle cannot be increased sufficiently, the occlusal stress must be reduced in order that a satisfactory relation between pressure exerted and ability to resist such pressure is attained.

Removable partial dentures which depend on mucosa for support must not transmit this stress other than in a rootwise vertical direction to the abutment teeth. When the denture is displaced because of compression forces occasioned by the stress of mastication, torquing strain must not be transmitted into the abutment teeth. These strains and stresses must either be minimized or eliminated by proper design of the retainer or some sort of stress-breaking action must be provided. Clasps are direct retainers whose function is to prevent the vertical dislodgment of the denture from its seat. Clasps may also serve as



VOL. III

OCTOBER 1952

NO. 10

# UNITED STATES ARMED FORCES MEDICAL JOURNAL

*Published Monthly by the Armed Forces Medical Publication  
Agency, Department of Defense*



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BENNETT F. AVERY, Captain, MC, U. S. N., Associate Editor

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THE PRINTING OF THIS PUBLICATION HAS BEEN APPROVED BY  
THE DIRECTOR OF THE BUREAU OF THE BUDGET, OCT. 19, 1949

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UNITED STATES  
GOVERNMENT PRINTING OFFICE  
WASHINGTON . 1952

For sale by the Superintendent of Documents, U. S. Government Printing Office  
Washington 25, D. C. Price 45 cents (single copy). Subscription price  
\$3.25 a year, \$1.35 additional for foreign mailing.

## FOREWORD

The *United States Armed Forces Medical Journal* is the medium for disseminating information of administrative and professional interest to all medical personnel of the Department of Defense. The Chairman of the Armed Forces Medical Policy Council and the Surgeons General of the several services invite all medical officers, dental officers, Medical Service Corps officers, Nurse Corps officers, and officers of the Veterinary Corps of the Armed Forces, and the medical consultants of the Army, Navy, and Air Force to submit manuscripts for publication in this Journal.

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Department of Defense.*

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WAYNE G. BRANDSTADT, *Editor-in-Chief,*  
*Colonel, Medical Corps,*  
*United States Army.*

ROBERT J. BENFORD, *Associate Editor,*  
*Colonel, Medical Corps,*  
*United States Air Force.*

BENNETT F. AVERY, *Associate Editor,*  
*Captain, Medical Corps,*  
*United States Navy.*

attention. Rovenstine (7), in a series of over 500 patients, stated that the severe postoperative pain of upper abdominal and thoracic operations responded poorly to procaine, but that about 66 percent of other surgical patients were relieved. One-third of this latter group responded to placebos.

Recently Keats et al. (8) reported a controlled and unselected series of 53 surgical patients, only 40 percent of whom obtained relief from postoperative pain with procaine, as contrasted with 20 percent who obtained relief with saline solution, and 70 percent who obtained relief with morphine given intravenously. He found that the analgesia was often accompanied by unpleasant and, at times, serious side effects. Because of the rapid fluid administration and the variability of toxic side effects, physician attendance was mandatory. Kibler and Schnaper (9), using the Wolff-Hardy and Goodell technic, discovered that procaine given intravenously elevated the pain threshold only slightly during the infusion period. They further emphasized that the answer awaits a controlled clinical test because the elevation of the pain threshold is only one of the possible modes of action of an analgesic.

**Method.** In a series of 50 patients, 5 percent dextrose in distilled water with 2 cc. of vitamin B complex for coloring was given intravenously immediately after operation when the patient first began complaining of pain. The patient was informed that the infusion was for the relief of pain. If pain persisted, procaine in the amount necessary to make a 0.2 percent solution, was added to the infusion. In the event the procaine failed, it was in turn replaced after from 30 to 60 minutes by a narcotic which was then evaluated for pain relief and comfort after another 30 to 60 minutes. Most of the procaine was administered by a trained nursing staff on the recovery ward. The 1 liter procaine infusion was administered over a period of 2 or 3 hours. One physician was on emergency call at all times. There were 23 orthopedic, 11 neurosurgical (excluding cranial), 10 urologic, and 6 major abdominal operations. Patients with thoracic operations were excluded on the basis of the poor results reported by Rovenstine (7).

The results are shown in table I. Half of the patients experienced some relief from pain. Most of those who obtained only partial relief stated that they were fairly comfortable. Two patients experienced complete relief from the dextrose in distilled water. Not more than 2 grams of procaine were administered in a 12-hour period, and those patients who experienced relief did not require analgesics until the following day. The narcotics ordered, usually demerol or morphine, gave relief in all but 1 patient.

(7) Rovenstine, E. L. Personal communication.

(8) Keats, A. S., D'Alessandro, G. L., and Bercher, H. K.: Controlled study of pain relief by intravenous procaine. Council on Pharmacy and Chemistry Sec. J. A. M. A. 167: 1761-1763, Dec. 29, 1951.

(9) Kibler, R. F., and Schnaper, H. W.: Effect of procaine administered intravenously on cutaneous pain threshold. Am. J. Med. Sc. 220: 199-202, Aug. 1950.

TABLE I. Results obtained from postoperative administration of procaine intravenously

Operation	Relief			Placebo given	Number	Percent obtaining relief*
	Complete	Partial	None			
Orthopedic	7	6	8	2	23	62
Neurosurgical	4	1	6		11	45
Urologic	1	2	7		10	30
Abdominal	1	3	2		6	66
Total	13	12	23	2	50	52

\*Patients getting placebo did not get the procaine and therefore were not included in this figure.

*Reactions were few and these were not serious. One patient developed a moderate hypotension; 1 experienced nausea, vomiting, and slow, thick speech; and 1 had marked dyspnea and was very apprehensive. Observers thought the dyspnea was due more to anxiety than to the procaine. It was rapidly relieved with an injection of phenobarbital.*

*Comment.* The effect of drugs on pain is difficult to evaluate. Only a rough clinical evaluation, based on relief of pain in a controlled series of 50 patients has been made. Procaine, given in the manner described, is impractical for alleviating postoperative pain because it often conflicts with the patient's fluid requirements and adds another uncomfortable needle. As an example, consider the patient whose intravenous infusion of 5 percent dextrose was begun in the operating room. Frequently, before the patient recovers from the anesthesia and begins to complain of pain, his fluid requirement has been absorbed. Cardiac patients necessarily present a formidable problem. The method also necessitates additional care, thus placing another load on over-worked nursing staffs. Reactions have been few, and despite earlier reports the method does not seem to require the continuous presence of a physician, but because only one-half of the patients respond, this procedure has no real advantage over the present method of treating postoperative pain.

#### CONCLUSIONS

Using a controlled series of 50 postoperative patients, an attempt was made to evaluate pain relief with the use of 0.2 percent procaine given intravenously. These patients underwent a cross section of major surgical (excluding thoracic) operations. Complete and partial relief was obtained in 50 percent of the patients and there were no serious reactions. The use of procaine for the control of postoperative pain is considered impractical because (1) it fails to give adequate pain relief in a high percent of patients, (2) it often interferes with the patient's fluid requirements, (3) it places an additional burden on the nursing staff, and (4) it means one more needle for the patient.

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# PERSONALITY CHANGES FOLLOWING CARDIAC ARREST<sup>(1)</sup>

JOHN N. GORDON, *Captain, MC, U.S.A.*

IRWIN R. STERNLIGHT, *First Lieutenant, MSC, A.U.S.*

OSWALD M. WEAVER, *Lieutenant Colonel, MC, U.S.A.*

PERSONALITY changes may occur as a result of cerebral anoxia, particularly when the anoxia is of sufficient duration to cause irreversible brain damage. Personality is considered to mean, "All a person has been, is now, and is trying to become. It is the entire individual including mind, intelligence, emotions and bodily organs. It embraces all of a person's attributes, his physical structure, his lives and his habits, his play and his work and his reaction to his environment and to everyone in it" (2). Personality changes resulting from cardiac arrest may range from mild, transient disturbances to total cessation of cerebral functioning and death. The personality changes from cardiac arrest are the result of anoxia and are, as a consequence, identical or similar to those caused by anoxia from any other cause.

The true significance of oxygen lack and the resultant histopathologic changes were summarized by Haldane (3) in 1912 when he said, "Anoxia not only stops the machine but wrecks the machinery." Courville (4) stated that anesthetic asphyxia may result in many personality changes and he listed 9 types of pathologic finding: (1) acute psychosis, (2) hypotkinesis, (3) decerebrate states, (4) residual psychoneurotic traits, often chronic, (5) certain chronic psychotic states, (6) parkinsonism, (7) lenticular syndrome, (8) blindness, and (9) rare and atypical manifestations. He also regarded asphyxia neonatorum as being the probable cause of many cases of spasticity, athetosis, and mental deficiency in children—conditions the cause of which had previously been obscure.

Cerebral anoxia from any cause, whether of the anoxic, anemic, stagnant, or histotoxic type, is an extremely serious disease. It has been estimated that cerebral anoxia for over 3½ minutes may result in

(1) Department of Neuropsychiatry, Fitzsimons Army Hospital, Denver, Colo.

(2) Menninger, W. C.: Psychiatry: Its Evolution and Present Status. Cornell University Press, Ithaca, N. Y. 1948. p. 4.

(3) Haldane: Quoted by Burdick, D. L.; Liss, J. R.; and Elias, M. G.: Anoxia and central nervous system; review and case report. *Anesthesiology* 10: 369-373, July 1949. Correction 10: 756, Nov. 1949.

(4) Courville, C. B.: Cerebral anoxia and its residuals; asphyxial syndromes, acute, subacute, and chronic. *M. Arts & Sc.* 2: 67-79, Apr. 1948.

he showed general mental retardation and disability but was compliant to repeated urgings and directions. He responded appropriately and relevantly at a moronic level. He was thin and weak but ate well when spoon fed. Unsupervised, he would urinate and defecate anywhere, but would take care not to soil himself. Although by 18 September he was improving, his vision was poor in both eyes and he could not count fingers. All operative wounds were healed.

He was transferred to this hospital, arriving on 22 October. He made a poor adjustment on the open ward and it became necessary to transfer him to the closed ward about 5 days after his admission because he would not bathe, had to be fed, and on one occasion put a cigarette out on a napkin, starting a small fire. He appeared pleasant but unkempt. His vision on 4 December was 20/400 bilaterally. This improved to 20/20 bilaterally by 21 December. Neurologic and mental status examinations included Rorschach, level aspiration, Wechsler-Bellevue, color form sorting, and Bender-Gestalt tests, Wechsler-Bellevue memory scale, and the Medical Field Service School test for aphasia (9, 10). The patient was unable to distinguish blue and green, and red and orange.

On the basic aphasia status examination (9) he revealed a number of signs indicating visual and partial tactile agnosia, graphomotor aphasia, and motor ataxia. The visual agnosia became evident on his not being able to recognize several common objects such as a key or a penny. The key was finally recognized when he grasped it, but he was unable to tell what the penny was, even when feeling it, other than it was possibly a coin. The graphomotor-visual aphasia was manifested in inability to write or even trace his name. His visual-motor ataxia was apparent in the manner in which he overcompensated for fluctuating depth perception. He lifted his legs quite high when walking and brought them uncertainly down to the floor, or else didn't lift them at all. He gave objects such as chairs and tables an unnecessarily wide berth.

Initially, on 25 October he could not function at all on the Wechsler-Bellevue performance subtests. On the verbal part, he scored zero on arithmetic but 10 on comprehension. His judgment was good but he concentrated poorly. His digit span score was 7, indicating an adequate recent memory function. His memory for past events was poor; for recent events, good (11, 12). He could not remember in what year he was born,

(9) TM 9-242-AFM 160-45. *Military Clinical Psychology*. Department of the Army and the Air Force, July 1953.

(10) Abt, L. E., and Bellak, L. (editors). *Projective Psychology*. Alfred A. Knopf, Inc., New York, N. Y. 1950.

(11) Rapaport, D., Gill, M., and Schaefer, R. *Diagnostic Psychological Testing. The Theory, Statistical Evaluation, and Diagnostic Application of Battery of Tests*. Vol. 1. Wenninger Clinic Monograph Series No. 3. Year Book Publishers, Inc., Chicago, Ill., 1945.

(12) Rapaport, D., Gill, M., and Schaefer, R. *Diagnostic Psychological Testing. The Theory, Statistical Evaluation, and Diagnostic Application of Battery of Tests*. Vol. 2. Wenninger Clinic Monograph Series No. 4. Year Book Publishers, Inc., Chicago, Ill., 1946.

but he could recall what he had had for breakfast. His general information was meager but suggested a premorbid level of average or better than average intelligence. He produced no scorable responses on the Rorschach test, but merely described the cards in terms of lines and curves in what was an attempt to impress the examiner with his precision, but succeeded only in being concrete (13). He was disoriented to time, missing the date by about a month. Motor signs included a cautious gait with heavy, high steps. On many occasions he stubbed his toe, but he overcame this handicap by watching his feet. He had a definite, mild dysdiadochokinesia which gradually improved. He was co-operative on the ward, but had to be carefully supervised at first. He showed interest in other patients and to the student nurses, saying in December about one of them, "I want to buy her for Christmas."

By 8 January 1952 minimal improvement could be noted in specific areas, such as abstract capacity as scored by the Wechsler-Bellevue test and in his aphasia and agnosia. No measurable improvement could be found in the area of long-term memory function or in his performance on other tests, although clinically the impression was one of improvement.

His mother thought he was functioning at about 40 percent of his normal level, but that most of his difficulty was in visual and memory areas. She, too, noticed much improvement as at first he did not recognize either her or his sister.

Because of his good judgment and immediate memory function and because he is treatable and shows a rather high level of frustration tolerance, the prognosis for further improvement under a concentrated retraining program appears to be good.

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(13) Goldstein, K., and Scheeret, M.: Abstract and Concrete Behavior. (*Psychological Monographs*, Vol. 53, No. 2.) American Psychological Association, Inc., Northwestern University, Evanston, Ill., 1941.

#### BOOK REVIEWS

A Textbook of Pathology, by E. T. Bell, M. D., Emeritus Professor of Pathology in the University of Minnesota, Minneapolis, Minn. Contributors: B. J. Clawson, M. D., Emeritus Professor of Pathology in the University of Minnesota, and J. S. McCartney, M. D., Professor of Pathology in the University of Minnesota. 7th edition. 1,008 pages; illustrated. Lea & Febiger, Philadelphia, Pa., publisher, 1952. Price \$12.

This book presents concisely the fundamental aspects of pathology in a well-organized and integrated fashion. It should be of especial value to medical students and beginners in path-

ology as well as to experienced pathologists who desire to review the entire field of pathology. This text is unusually complete and gives an excellent coverage of the subjects usually included in such a book.

Pathology, like other branches in medicine, has become increasingly complex and this book succeeds in clarifying some of its confusing aspects. It takes up the basic fundamentals but they have been greatly enlarged on since the publication of the first edition. The diseases of the blood, a subject which is becoming more and more complicated, are especially well-discussed. The chapter on tumors is also especially good. It includes a general discussion and a section on the causes of tumors which is up to date, including experimental production of cancer, and then finally the classification of tumors and the discussion of each group. Students would save themselves a great deal of misdirected effort by applying themselves to this section and making it a part of their basic knowledge.

—Col. D. V. Kuhns, MC, U. S. A.

*Text-Book of Ophthalmology. Volume V. The Ocular Adnexa*, by Sir Stewart Duke-Elder, K. C. V. O., M. A., LL. D., D. Sc. (St. And.), Ph. D. (London), M. D., F. R. C. S., Hon. D. Sc. (Northwestern), D. M. (Utrecht), F. R. C. S. (Edin.), F. A. C. S., Surgeon Oculist to H. M. The King, Knight of Grace, Order of St. John, Consulting Ophthalmic Surgeon to the British Army and the Royal Air Force, Fellow, University College, London, Director of Research, Institute of Ophthalmology, University of London, Honorary Consulting Surgeon, Moorfields Westminster and Central Eye Hospital, Ophthalmic Surgeon, St. George's Hospital, London. 1082 pages, 1181 illustrations, 32 in color. The C. V. Mosby Co., St. Louis, Mo., publisher, 1952.

The first 4 volumes of this textbook were enthusiastically accepted as most outstanding contributions to modern ophthalmic literature. Volume 5 adds another superior book to this series. It covers in great detail developmental anomalies and diseases of the lids, the lacrimal apparatus, the orbit, and of the para-orbital regions. The volume is written in the inimitable Duke-Elder style, superbly illustrated, and well printed. This book belongs, with the preceding volumes by the same author, in the library of every ophthalmologist and as a reference in every library available to the physician. It is not intended for the medical student but is indispensable to the resident in ophthalmology. The appearance of a volume in this series in past years has been hailed as a major event in the advance of ophthalmology. This year is no exception and we eagerly look forward to the next volume.—Col. J. H. King, Jr., MC, U. S. A.

# THE URINOIL<sup>(1)</sup>

INGALLS H. SIMMONS, *Lieutenant Colonel, MC, U. S. A.*

VERNON H. NEUBERT, *First Lieutenant, MSC, A. U. S.*

ARTHUR L. QUAGLIERI, *Second Lieutenant, MSC, A. U. S.*

**D**ISPOSAL of urine in semipermanent camps has long presented a problem in sanitation. The common urinal trough or pipe urinal is usually far from odorless and attracts flies and other insects. The following are a few of the special precautions which must be taken to insure the proper functioning of the urine-soakage pit: (1) men must not urinate on the pit itself; (2) the grass or straw in the funnels must be changed daily and the funnels cleaned with soap and water and changed when necessary; and (3) the pit must be kept free from oil or any other substance which might clog it.

To alleviate these problems, a special type of field urinal, the "Urinoil," was designed and constructed at this post. Urine in this urinoil is constantly covered with oil, thus furnishing no urine-contaminated surface which will attract flies. No cleaning is required. After the urinoil is installed, no maintenance is required, except to remove debris from the screen periodically to prevent clogging. The entire urinoil may be built from salvaged material.

*Functioning of the urinoil.* Because urine has a higher specific gravity than oil, it immediately disappears on striking the oil and flows directly to the bottom of the drum (fig. 1). The column of urine between the 3-inch and the 1½-inch pipe and the urine accumulated in the bottom of the drum supports the column of oil in the drum similar to a U-tube, one leg of which is filled with waste oil and the other with urine. The top of the urine column is at the 1-inch notch in the top of the 1½-inch pipe. The oil level is higher because of the difference in specific gravity of the urine and the oil. When additional urine is added, the urine overflows through the notch in the 1½-inch pipe and down through this pipe into the soakage pit. This overflow continues until the difference in specific gravity between the oil and the urine is equalized. The 3-inch pipe acts, much as a haffle in a grease trap, to prevent the oil from passing into the soakage pit.

*Construction of the urinoil.* The shell of the urinoil is a salvaged empty 55-gallon drum with the top removed. A hole is cut or burned through the bottom of the drum, large enough for the 1½-inch pipe, which is cut to the length shown in figure 1. One

### BOOK REVIEWS

*Fundamentals of Neurology*, by Ernest Gardner, M. D., Professor of Anatomy, Wayne University College of Medicine, Detroit. 2d edition. 359 pages, illustrated. W. B. Saunders Co., Philadelphia, Pa., publisher, 1952.

This book is primarily for beginning students in neurology but nurses, physiotherapists, and those pursuing courses in zoology or psychology will find it most useful in the better understanding of neurologic patients. The neurologist, however, will find it worth reading. In a simplified manner, the basic concepts of all aspects of neurology are presented. The sections on nerve conduction, motor pathways, and cerebral cortex have been revised and are interestingly presented in the light of newer knowledge since publication of the first edition in 1947. The text is well written, the photographs are superb, and the diagrams are clear and uncomplicated. Each chapter is summarized and is followed by short biographies of one or several outstanding men in neurology whose fame is related to the subject matter just presented. Several references follow each chapter. Immediately preceding the index is a glossary of neurologic terms. This book is strongly recommended as an introduction to neurology and its allied fields.

—Lt. Col. J. W. Sumner, MC, U. S. A.

*Textbook of Medicine*, by various authors. Edited by Sir John Combeare, K. B. E., M. C., D. M. (Oxon.), F. R. C. P., Physician to Guy's Hospital, London, and W. N. Mann, M. D. (Lond.), F. R. C. P., Assistant Physician to Guy's Hospital, London. 10th edition. 912 pages, illustrated. The Williams & Wilkins Co., Baltimore, Md., publisher, 1952. Price \$8.

This text on general medical subjects has maintained its simple, brief form in spite of 23 years of publication and 10 editions. It includes satisfactory discussion of such modern subjects as acceleration problems and, at times, reaches beyond the confines of internal medicine proper in the direction of pediatrics, psychiatry, and dermatology. In spite of wide subject coverage and an author's responsibility to repeat all the usual routine information which a student requires, the several collaborators have found space to include much advice on the art of medical practice. It is suggested, for instance, that the doctor warm his hands before examining an abdomen, that pains be taken to forearm the diabetic patient of the possibility of local insulin fat atrophy, and that the invalidism which may result directly from the mere prescription of a diet may be more disabling than the disease being treated. This is a thoroughly effective effort to put basic information together in a readable way for the medical student. It is hoped that more effective illustrations will be provided in future editions.—Lt. Col. E. D. Palmer, MC, U. S. A.

# OXYPOLYGELATIN AS A PLASMA SUBSTITUTE<sup>(1)</sup>

JOSEPH S. CHEN, M. S.

M. L. CHEN, B. S.

S. S. LIN, B. S.

A. S. CHANG, M. D.

**O**XYPOLYGELATIN (OPG) was first introduced by Pauling (2) in 1946. As an oxidized compound of polymerized gelatin fragments, it was claimed to be a better plasma substitute than gelatin itself. Literature concerning its use has been scanty (3, 4). This report deals with some biochemical and clinical studies on OPG.

## EXPERIMENTAL DATA

*Method of preparation.* OPG was synthesized according to Pauling's procedure. Difco gelatin was used as the starting material. The optimal amount of glyoxal used for coupling and of hydrogen peroxide for oxidation was found to be 0.025 gram of each per gram of gelatin. Determined according to its nitrogen content, the final saline solution was 5.4 percent (wt./vol.) in concentration, dark tan, with a pH of 6.4. Other gelatin solutions were prepared for comparison.

1. Plain gelatin solutions. Batches of 6 percent (wt./vol.) gelatin in normal saline solution were made up. These solutions, labelled PAG, RAG, and TAG, were autoclaved for 20 minutes at 15-lb. pressure once, twice, and 3 times respectively.

2. Oxidized gelatin (Oxy-G) solutions were prepared by adding 0.02 gram of hydrogen peroxide per gram of gelatin to PAG and autoclaving once to allow for oxidation.

*Physical-chemical properties.* Some of the physical and chemical properties of OPG and other gelatin solutions were determined (table I). For comparison, the determination of Pauling's 11381Y preparation, Knox-P-20 clinical gelatin solution were also made and listed.

(1) Department of Biochemistry, National Defense Medical Center and the Surgical Service, First Armed Forces General Hospital, Taipei, Taiwan, China.

(2) Pauling, L.: Final Report on Chemical Modification of Protein as Blood Substitute. 1946.

(3) McCarthy, M. D., and Parkins, W. M.: Comparative effectiveness of albumin, globin, hemoglobin, gelatin, oxypolygelatin, saline, Ringer's, blood and plasma upon survival of rats subjected to standardized scald burns. Am. J. Physiol., 150: 428-443, Sept. 1947.

(4) Koop, C. E.: Plasma substitutes. Am. J. M. Sc. 213: 233-240, Feb. 1947.

Our OPG solution had a lower osmotic pressure and relative viscosity than Pauling's preparation. Its molecular weight calculated from osmotic pressure was about 35,000 which is about one half that of human serum albumin. Unlike Pauling's, our OPG solution does not form gel at 5° C. These differences indicate that our OPG might differ from Pauling's in molecular structure because of a difference in either the basic material used, or to reaction conditions, or both. The successive autoclaving of PAG to turn it to TAG induced a significant increase in osmotic pressure and a decrease in relative viscosity without changing the fluidity of the product. After oxidation, however, the consistency of PAG was changed, i. e., the resultant Oxy-G was a

TABLE I. Physical-chemical properties of OPG and other gelatin solutions

	Final protein concentration (percent)	Final pH	Osmotic pressure* (mm. H <sub>2</sub> O)	Relative viscosity*	Consistency at 5° C.
PAG	6.0	7.2	26	1.35	gel
RAG	6.0	7.1	44	1.29	gel
TAG	6.0	6.8	47	1.26	gel
Oxy-G	6.0	6.4	43	1.20	semigel
OPG	5.4	6.4	78	1.18	sol
Re-OPG	5.4	7.2	234	1.13	sol
Knox-P-20**	6.0	7.2	96	1.35	gel
II381Y***	5.2	5.6	98	1.35	gel

\*Determination was made on 1 percent solution at 37.5° C.

\*\*Made in Knox Laboratory.

\*\*\*Made in the California Institute of Technology.

semigel at 5° C. It was apparent, therefore, that a reduction in molecular size did not change the consistency of gelatin from gel to sol, but oxidation did. When OPG was reautoclaved after the final pH was adjusted from 6.8 to 7.2, Re-OPG resulted and showed marked increase in osmotic pressure and only slight decrease in relative viscosity. Because gelatin is readily hydrolyzed under high pressure sterilization, it was presumed that on reautoclaving there would be more chance for the molecular cleavage of OPG to take place at the peptide linkage than at the oxime linkage.

*Physiologic experiments.* The following experiments were designed primarily to evaluate the effectiveness of GPG in combating shock and in the maintenance of circulating volume after hemorrhage, the duration of retention in the circulation, pyrogenicity, and toxicity.

1. Pyrogenicity. The U. S. P. method of testing for pyrogens was

used, but instead of 3 rabbits, 4 (1 for control and 3 for testing) were used for each test. The test rabbits were given intravenous injections of 10 ml. per kg. body weight of various preparations and the control rabbit received no injection. The results are shown in table 2. OPG, Re-OPG, and Oxy-G gave no pyrogenic reaction, indicating that pyrogens could be destroyed during oxidation by hydrogen peroxide.

2. Maintenance of adequate blood pressure following hemorrhage. Rabbits of about 2 kg. body weight were anesthetized with ether and 20 ml. of blood per kg. body weight were removed from the left femoral artery. Signs of shock generally set in after from 40 to 50 ml. of blood had been withdrawn and could be effectively checked when an equal volume of OPG was given soon after its onset. The procedure was re-

TABLE 2. Pyrogenicity of different preparations

	Temperature rise (degrees C.)		Interpretation
	Maximum	Average	
PAG	1.50	1.05	Pyrogenic
RAG	0.84	0.80	Pyrogenic
TAG	0.81	0.60	Pyrogenic
Oxy-G	0.44	0.21	Nonpyrogenic
OPG	0.33	0.27	Nonpyrogenic
Re-OPG	0.28	0.28	Nonpyrogenic
I1381Y	0.10	0.18	Nonpyrogenic

peated under similar aseptic conditions on over 50 rabbits and no untoward reactions were observed during or after infusion. No deaths were recorded.

Dogs were prepared for direct measurement of blood pressure by anesthetization with 0.3 gram of phenobarbital per kg. The carotid artery was cannulated for blood pressure tracing on a kymograph. From 20 to 25 ml. of blood per kg. body weight were then removed from the femoral artery. The hemorrhage was followed by replacement of an equal volume of OPG with good results. After a single massive hemorrhage (500 ml.) the diastolic pressure of dog 25 (fig. 1) dropped from 90 to 10 and the pulse rate became almost nil. Following an infusion of the same volume of OPG the diastolic pressure was raised promptly to about 130. It was also found that the stroke volume of the heart, as indicated by the amplitude, was increased by OPG. Similar results were obtained with dog 21.

3. The fate of OPG after infusion. Rabbits were placed in metabolic cages and allowed to take about 3 grams of nitrogen daily on a stock diet and distilled water as desired. Urine and feces were collected

every other day instead of daily in order that wide differences in daily urine volume might be minimized. A few crystals of thymol were put into each urine receiver as an antiseptic. One volume of 10 percent sodium tungstate solution and 4 volumes of 2N/3 sulfuric acid were used to precipitate urinary protein from 5 volumes of urine. The non-protein nitrogen in the supernatant fluid was determined to check the degree of accuracy of protein nitrogen values obtained from the precipitate after resolution in alkali. The micro-Kjeldahl method was used in all nitrogen determinations. After establishment of a positive nitrogen balance for 2 days, each rabbit was given an intravenous dose of 10 ml. of OPG per kg. body weight. The collection of urine and feces continued until the nitrogen values returned to the basal levels. The whole experiment took 14 days. Six rabbits, including 2 controls, were used for each experiment.

The average urinary excretion of protein nitrogen in 2-day periods of the 4 control rabbits which received no OPG injection was 12.72 mg. (range 4.81 to 20.94 mg.).

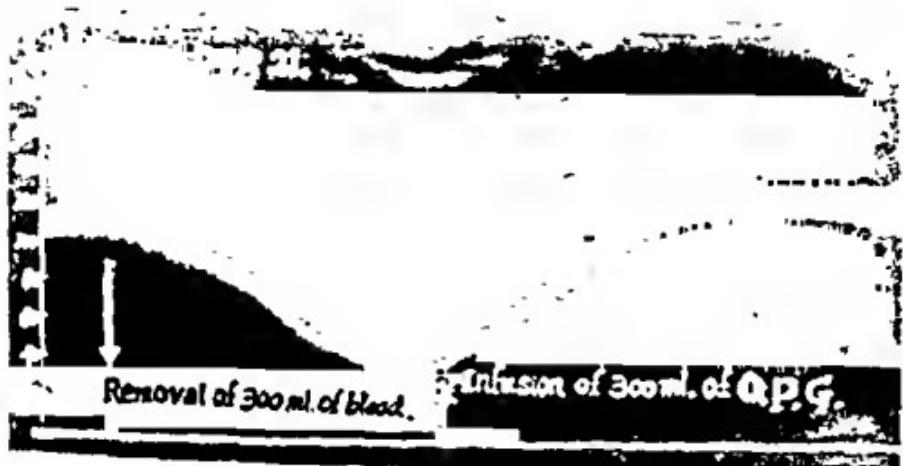
Table 3 shows the excretion of OPG expressed in protein nitrogen in the test rabbits. During the control period, the protein nitrogen excreted varied from 2.52 to 31 mg. (average 14.94 mg.) per 2-day period, comparable to the corresponding value for the control rabbits. After an injection of OPG, the rabbits excreted on the average 36.18 percent of the OPG in the first 2 days, 23.76 percent in the next 2 days, gradually leveling off from 6 to 10 days. The total excretion of OPG varied from 46.95 percent to 103.52 percent of the amount injected (mean 73.93 percent), indicating that OPG remains in the circulation for several days before its complete disappearance. A large part (73.93 percent) of the injected OPG was probably excreted unchanged. Whether the remaining 26.07 percent was retained in the circulation or was utilized is not known at present.

The test rabbits often showed a significant increase of amino nitrogen excretion after OPG injection. Because all the rabbits gained weight during the course of the experiment, no evidence of tissue damage was found in the toxicity experiment and, because of the possible presence of a proteolytic enzyme in the serum as reported recently (5), we must consider the possibility of the utilization of OPG after intravenous injection. The excretion of amino nitrogen from both test and control animals showed such wide variations that no definite conclusions could be drawn.

4. Toxicity. Two rabbits (no. 3 and 4) were sacrificed after weekly injections of 10 ml. of OPG per kg. for 6 weeks. Gross and microscopic examinations of internal organs, including the heart, lungs, liver, kidney, and spleen, showed nothing significant, nor was any storage effect discerned. Another rabbit (no. 11) was given OPG 3 times within a week

(5) Cliftion, E. E., and Cannamela, D. A. Variations in proteolytic activity of serum of animals including man. Proc. Soc. Exper. Biol. & Med. 77: 305-308, June 1951.

by mistake and it died of heart failure. Microscopic study of its internal organs revealed venous congestion. Because the metabolic study showed that about 60 percent of the OPG remained in the circulation 3 days after injection, it may be surmised that the death of this rabbit was the direct result of an overburdening of the heart rather than of any toxic effects of the OPG.



Dog 25.

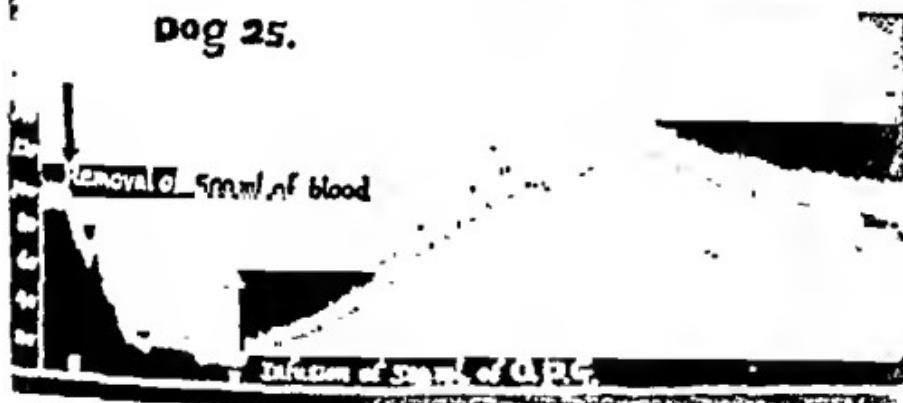


Figure 1. Kymograms of continuous blood pressure measurement on 2 dogs treated with OPG after a single massive hemorrhage.

#### CLINICAL TESTS

Eight patients on whom chest or abdominal operations were performed were given from 500 to 1,000 ml. of OPG at a rate of from 5 to 10 ml. per minute either during or after operation. There was no untoward reaction either during or 24 hours after the infusion. The data obtained are shown in table 4.

**Reaction and temperature.** With the exception of patients 6 and 7, who showed an increase of body temperature 6 hours after infusion, and patient 5, who showed an increase 12 hours after infusion, none of

TABLE I. 3. Urinary excretion of OPG expressed as protein-nitrogen

Rabbit number	Urinary protein nitrogen excretion in 2 days before OPG injection (mR.)	OPG injected in terms of protein nitrogen (mR.)	Excretion of urinary protein nitrogen (mR.)			
			1-2	3-4	5-6	7-8
5	23.00	172.8	93.00	69.00	35.00	14.2
17	6.72	190.6	102.00	60.00	22.00	22.8
1	19.40	181.0	71.60	63.20	34.40	28.8
6	16.20	172.8	84.80	54.60	18.80	15.2
19	9.28	190.0	101.00	36.00	7.20	11.8
9	31.00	147.0	39.40	64.40	36.80	50.0
28	2.52	190.0	79.34	79.34	43.50	3.0
27	11.40	190.0	58.00	36.40	24.80	15.0
Mean	14.94	180.4	81.14	57.87	28.06	20.1
						26.13

TABLE 3. Urinary excretion of OPG expressed as protein-nitrogen—Continued

Mg.	Percent	1-2			3-4			5-6			7-8			9-10			Mg.	Percent
		Mg.	Percent	Mg.	Percent	Mg.	Percent	Mg.	Percent	Mg.	Percent	Mg.	Percent	Mg.	Percent			
(4)																		
70.00	40.51	46.00	26.62	12.00	6.94	-	-	-	-	-	-	-	-	128.00	74.07			
95.28	47.98	53.28	26.83	15.28	7.69	16.08	8.10	-	-	-	-	-	-	179.92	90.60			
52.20	28.68	43.80	24.07	15.00	8.24	9.40	5.16	5.80	3.19	-	-	-	-	126.20	69.34			
68.60	39.70	38.40	22.22	2.60	1.50	-	-	-	-	-	-	-	-	109.60	63.42			
91.72	48.27	26.72	14.06	-	-	2.52	1.33	-	-	-	-	-	-	120.96	63.66			
28.40	19.32	33.40	22.72	5.80	3.95	19.00	12.93	10.20	6.94	-	-	-	-	96.80	65.86			
76.82	40.43	76.82	40.43	42.98	22.62	0.08	0.04	-	-	-	-	-	-	196.70	103.52			
46.60	24.53	25.00	13.16	13.40	7.05	3.60	1.89	0.60	0.32	-	-	-	-	89.20	46.95			
66.20	36.18	42.93	23.76	13.38	7.42	6.34	3.51	5.53	3.06	-	-	-	-	138.46	73.93			

\*Values in mg. are based on excess of urinary protein nitrogen over the control value (column 1). Percentages express proportions of protein nitrogen excreted in relation to the amounts of OPG originally injected (column 2).

\*\*Totals in each row are the sums of the values in column 4. The two means in mg. and percentage are calculated in the same way and not by averaging the vertical values in column 5 because of uneven distribution of values.

TABLE 4. Clinical observations on a group of patients who received OPG (1)

Time	Before infusion	Hours after infusion			
		1	6	12	24
<b>Patient 1 (2, 3)</b>					
Temperature C. (rectal)	38.3	38.3	38.4	38.5	38.3
Pulse rate	100	99	98	97	96
Respiration	24	25	24	24	23
Blood pressure	100/70	105/74	104/78	110/80	112/82
Erythrocyte count (million)	3.5				3.7
<b>Patient 2 (4, 5)</b>					
Temperature C. (rectal)	37.0	37.6	37.4	37.4	37.6
Pulse rate	60	94	94	84	96
Respiration	16	18	18	18	18
Blood pressure	110/70	120/80	130/90	130/90	140/98
Erythrocyte count (million)	4.2	4.2	4.0	4.2	4.4
<b>Patient 3 (2, 6)</b>					
Temperature C. (rectal)	39.4	39.4	39.3	39.0	
Pulse rate	145	130	124	124	
Respiration	26	23	24	24	
Blood pressure	88/55	100/60	108/68	108/62	
Erythrocyte count (million)					
<b>Patient 4 (4, 7)</b>					
Temperature C. (rectal)					
Pulse rate	68	90	98		86
Respiration			27		24
Blood pressure	98 (sys)	90 (sys)	110/60		110/60
Erythrocyte count (million)	4.0		4.27		4.39
<b>Patient 5 (2, 8)</b>					
Temperature C. (rectal)	36.8	37.0	36.6	38.0	38.2
Pulse rate	74	85	130	120	120
Respiration	30	42	40	48	40
Blood pressure	114/72	120/60	125/80	115/70	130/84
Erythrocyte count (million)	4.3	4.0	4.0	4.0	4.0

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TABLE 4. Clinical observations on a group of patients who received OPG (1)—Continued

Time	Before infusion	Hours after infusion			
		1	6	12	24
<b>Patient 6 (2, 9)</b>					
Temperature C. (rectal)	37.0	37.0	38.0	38.0	38.0
Pulse rate	70	80	110	80	77
Respiration	28	30	32	30	24
Blood pressure	106/64	110/70	120/70	100/68	90/64
Erythrocyte count (million)	3.5	3.0	3.0	4.0	3.4
<b>Patient 7 (2, 10)</b>					
Temperature C. (rectal)	37.7	37.7	38.0	38.0	38.2
Pulse rate	80	100	90	84	80
Respiration					
Blood pressure	106/80	110/80	120/78	130/80	120/78
Erythrocyte count (million)	4.0				3.9
<b>Patient 8 (2, 3)</b>					
Temperature C. (rectal)	38.2	37.5	37.2	37.4	37.4
Pulse rate	95	99	110	102	104
Respiration	26	26	25	26	26
Blood pressure	110/70	115/60	110/80	110/84	112/82
Erythrocyte count (million)	3.8				3.8

• station or other adverse effects.

(8) Male; had lung cyst.

(9) Female; had neoplastic stricture of descending colon.

(10) Female; had acute generalized peritonitis.

the patients showed temperature changes. These 3 patients complained, however, of no subjective discomfort, feverishness, dizziness, or chilliness. The increase in temperature varied from  $0.8^{\circ}$  to  $1.2^{\circ}$  C. which could have been due to postoperative reaction or normal fluctuation (6, 7).

(6) Best, C. H., and Taylor, N. B.: The Physiological Basis of Medical Practice. 4th edition. Williams & Wilkins Co., Baltimore, Md., 1945, p. 623.

(7) Chang, H. L.; Cheo, J. S.; Chiang, C. H.; Chen, M. L.; and Yue, J. C.: Dextran infusion in normal Chinese men. Armed Forces M. J. 2: 341-352, Mar. 1952.

The authors use the cube technic of electrode placement and record the electromotive forces in horizontal, sagittal, and vertical planes. This technic does not require stereoprojection or construction of model loops to obtain spatial orientation of the vector loop.

The book includes an extensive bibliography and an index. It is profusely illustrated and a uniform system of vector and electrocardiographic photography is used throughout. The clarity of presentation makes this monograph more readable and understandable than other publications on the same subject. The authors have failed to indicate the basis for the diagnosis of myocardial infarction, ventricular hypertrophy, and the differentiation between ventricular hypertrophy and bundle branch block. The representative cases used in a publication demonstrating correlative findings with clinical electrocardiography and attempting to establish diagnostic criteria for vectorcardiography should use only instances in which the pathologic diagnosis has been established by autopsy. If this was done, no mention was made of it.

—Col. T. W. Mattingly, MC, U. S. A.

*Circulatory Dynamics, Physiologic Studies*, by Carl J. Wiggers, M. D., Sc. D., F. A. C. P., Professor of Physiology and Director, Department of Physiology, School of Medicine, Western Reserve University, Cleveland, Ohio. Modern Medical Monographs, No. 4. 107 pages, illustrated. Grune & Stratton, Inc., New York, N. Y., publishers, 1952. Price \$4.

The author has recast certain lectures dealing with experimental aspects of circulatory dynamics into book form with the thought that such a collection would be useful to investigators and progressive practitioners having concern with human circulatory dynamics. This objective is amply fulfilled. This monograph deals first with hemodynamic laws, and analysis of the practical information which can be gained from arterial pressure readings and arterial pulse registrations plus illustrations of how such information increases understanding of the dynamics of hypertension. The second section deals with the mechanisms by which the ventricles adapt to altered circulatory states in health and disease. The last section is devoted to interpretations of ventricular contraction patterns by analysis of ventricular pressure curves. The author discusses the alterations which take place as a result of pericardial effusion, hypervolemia, oligemia, arterial hypertension, aortic coarctation, aortic and pulmonary stenosis, idioventricular rhythms, ventricular alteration, coronary occlusion, myocardial ischemia, and valvular lesions.—Lt. Col. F. L. Bauer, MC, U. S. A.

# PLASTIC CLOSURE OF ORO-ANTRAL FISTULA

EDWARD C. RAFFETTO, *Captain, DC, U. S. N. (1)*

THE maxillary sinus is occasionally involved by the extraction of teeth or procedures for the removal of fractured roots as the floor of the sinus is sometimes in close relationship to the apexes of the maxillary molars and premolars. Patients with oro-antral fistulas are frequently referred to the dental service for plastic repair. A satisfactory method of plastic closure is presented in the following case report.

## CASE REPORT

A 40-year-old man had the first and second maxillary right molars removed on 6 September 1951. Immediately following the extractions, an operation to close the defect was performed by suturing the soft tissues buccopalatally but it was unsuccessful. The patient was seen in consultation on 20 November. The maxillary right posterior teeth were missing and an oro-antral fistula was present in the area of the first molar. An opening about 8 mm. in diameter was present with granulationlike tissue prolapsing through the fistula. The patient's chief complaint was the passage of air and, occasionally, of fluids from the mouth into the antrum and out the nose.

The patient was admitted to the hospital on 3 December at which time physical examination was essentially negative except for the communication between the right maxillary sinus and the oral cavity. There was no pain and no evidence of suppuration. Roentgenograms of the sinus area showed no evidence of root fragments or foreign bodies. The granulationlike tissue prolapsing from the opening prevented air from passing freely on forceful exhalation against closed nostrils. A large aspirating needle was inserted through the opening into the sinus and the patient was again asked to exhale against his tightly held nostrils. Air passed freely through the needle, indicating a patent ostium and probably a clean antrum. A maxillary impression was taken and a study model made on which was constructed a clear acrylic full-palate splint.

Roentgenographic examination of the paranasal sinuses showed cloudiness of both maxillary antrums with mucosal thickening along the inferior lateral sinus wall. The other sinuses appear clear and well aerated. The findings were consistent with a chronic maxillary sinusitis.

(1) U. S. Naval Hospital, Newport, R. I.

The rhinologist saw the patient, found no evidence of a purulent discharge, and advised against an antronasal opening. A plastic closure was decided on. The patient was given 300,000 units of penicillin daily. The full-palate acrylic splint was placed in position and was found to fit satisfactorily. The splint was relieved over the area covering the proposed flap. The patient was given 10 mg. of morphine sulfate and 100 mg. of pentobarbital 1 hour prior to operation. The remaining teeth were cleaned and the mouth sprayed with an alkaline mouthwash and irrigated with normal saline solution. The following injections of a solution containing 2 percent lidocaine and epinephrine in a dilution of 1:50,000 were made: (1) posterior palatine, (2) anterior palatine, (3) tuberosity, and (4) infiltration of buccal areas.

The margins of the fistula were excised by making a circular incision about 3 mm. from the opening. By means of mosquito forceps and curets, all granulation tissue was removed through the fistula. The forceps were extended through the opening into the lower section of the antrum and as much fragile granulation tissue as possible was removed.

The flap was designed. The palatal mucosa was incised down to the bone. Starting to the right of the median line opposite the second molar area the incision was extended forward to the cuspid area, curving around to make the flap about 1 cm. in width, and was extended back to the second molar area. The flap was carefully detached to include the periosteum. The small section of palatal mucosa adjacent to the fistula was removed and the mucosa on the buccal side of the opening was undermined with a periosteal elevator to facilitate the placement of the flap. A small section was cut on the lesser curvature to prevent folding of the flap as it was turned. The flap was placed in contact with the recipient area and was found to cover the opening. It laid in good relationship to the adjacent tissue, and was secured in position by means of seven 0000 nylon interrupted sutures. The acrylic palatal splint was inserted and no pressure points could be seen on the palatal flap. It was not necessary to insert gauze packing in the donor site.

Bed rest was prescribed for the first 48 hours after operation. Liquid diet was given for the first week. The patient was allowed 100 mg. of demerol every 4 hours if needed. An ice pack was placed on the right side of his face for 25 minutes every hour for the first 6 hours after operation. Nose drops containing 1 percent ephedrine sulfate were instilled in his nostrils every 6 hours. He was instructed to rinse his mouth gently with a saline mouthwash after each meal. He was advised not to smoke or exert any suction in the oral cavity, and not to blow his nose. A bloody nasal discharge was present for the first 7 days, especially in the mornings. The palatal splint was removed and cleaned daily after the third postoperative day. The sutures were removed on the ninth postoperative day. The patient was discharged to duty on 21 December and was instructed to wear the palatal splint for another 2 weeks. He was asked to continue to avoid sucking action and was started on a soft diet. Three weeks later the area was completely healed.

The use of a clear acrylic splint following closure of an oro-antral fistula by plastic repair is worthy of consideration. Healing seems to progress without complication and there is no need for placing a packing in the donor site. It is essential that the ostium of the sinus be open for proper ventilation of the antrum or an antronal window made prior to closure of oro-antral fistula. Definite and detailed postoperative instructions to the patient are necessary.

#### BOOK REVIEWS

*Cunningham's Text-Book of Anatomy*, edited by James Couper Brasb, M. C., M. A., M. D., D. Sc., F. R. C. S. Ed., F. R. S. E., Professor of Anatomy, University of Edinburgh. 9th edition. 1,604 pages; illustrated by 1,252 text figures, 699 of which are printed in colors, and 88 plates including 145 radiographs. Oxford University Press, New York, N. Y., publisher, 1951. Price \$14.

This new edition is invaluable, not only for the undergraduate medical student and those engaged in teaching, but also for the practicing physician who desires a ready reference in anatomy. The editors have made every effort to improve this edition by revision of certain sections, by better and more illustrations, and by including new material. Free use of colored illustrations, diagrams, and radiographs enhance the value of this work. The content is well set forth with both a complete table of contents and an adequate index. The extensive bibliography at the end of each section is a distinct improvement. The recency of some of the references makes the reader realize that there is yet much to learn in the field of anatomy. Finally, the print is excellent and the volume is well constructed.

—Col. P. S. Fancher, MC, U. S. A.

*Living in Balance*, by Frank S. Caprio, M. D. 246 pages. The Arundel Press, Inc., Washington, D. C., publisher, 1951. Price \$3.75.

Although this worth-while book was written primarily for the lay person, many of the author's views will interest psychiatrists and other professional workers in the field of mental health. Due to popular demand and interest, there has been a deluge of publications on psychiatric subjects, many of which are the work of poorly qualified and ill-informed writers. Dr. Caprio's book is an outstanding exception. The author has presented, with unusual clarity, the recognized concepts of the various neurotic mechanisms and their impact on normal living.

His approach begins, quite appropriately, with a concept of the normal personality and what might be considered to be the healthy adjustment to living. He then continues with an interesting explanation of the various neurotic disorders in a fashion designed to appeal to the reader whose previous understanding and knowledge of such material has been limited. Several chapters devoted to the marriage relationship may well serve to dispel certain existing confusions in the minds of marital partners. Special problems of living, such as alcoholism and suicide, are discussed in a manner designed to give understanding and reassurance to the distressed. A chapter entitled, "First Aid for Mental Injuries" is unique, as is the one entitled, "A Chart to Happiness," both designed to give the reader some degree of insight into his problems and to assist him to achieve a balanced life.—*Lt. Col. C. T. Brown, MC, U. S. A.*

*New and Nonofficial Remedies, Containing Descriptions of the Articles Which Stand Accepted by the Council on Pharmacy and Chemistry of the American Medical Association on January 1, 1952. Issued under the Direction of the Council on Pharmacy and Chemistry, American Medical Association. 838 pages. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1952. Price \$3.*

This book is an annual publication of the Council of Pharmacy and Chemistry of the American Medical Association. The 1952 edition contains articles found acceptable through 1 January 1952. Drugs are not automatically considered for acceptance when they become commercially available, but must be submitted for consideration by the interested pharmaceutical manufacturers.

The book is divided into two major sections. Section A consists of short monographs describing the actions, uses, and dosage of individual drugs. These articles are arranged according to broad therapeutic classifications. Section B consists of tests and standards for accepted drugs or dosage forms not official in the U. S. P. or N. F. The arrangement is alphabetical according to generic names. Articles which have been accepted for 20 or more years are not described in Section A, but tests and standards for unofficial drugs are included in Section B. The book is provided with a bibliographic index of unaccepted products and a general index. The general index includes references to the most recent edition of New and Nonofficial Remedies which describes accepted products not included in the 1952 edition.

This book is an essential part of the pharmacist's library. It should be readily available to all physicians.

—*Capt. J. W. McNamara, MSC, U. S. A.*

# COMMON CAUSES OF PAIN ABOUT THE JAWS

ROBERT L. PEKARSKY, Captain, DC, U. S. A.

THE soldier reporting to the dentist often points vaguely to an area of his face and says, "The pain is about in here." The treatment of such a patient in the combat zone of Korea can be a difficult problem. In spite of the limited equipment available, a correct diagnosis can be made and the condition successfully treated in an evacuation hospital through the use of the portable x-ray machine and the instruments supplied in Chests 60 and 61.

I usually start by trying to get the patient to localize the pain more exactly, then I ask how long he has had the pain. If he has had it on and off for several years but it has suddenly become worse in the preceding 3 weeks, I ask how long he has been in the Army and how long he has been overseas. If he answers, "Three weeks," it is more than likely that he is an unstable person and as such that he has a lower threshold of reaction to pain than a more normal person. The patient is then asked whether he has a toothache along with the pain in the jaw. If he says, "Yes," you can usually discover the offending tooth and decide whether to fill or extract it.

It should be determined whether the patient has been in any fights, fallen, or been in an accident recently and whether he has a feeling that his teeth do not come together properly. If the reply is, "Yes," a radiographic examination of the jaws should be done because the patient may have a fractured maxilla or mandible, causing a malocclusion. He should be asked whether he has any difficulty opening his mouth or in swallowing. The presence of trismus will suggest the presence of edema in the lateral pharynx, masseter, or internal pterygoid muscles, originating from an unerupted and impacted third molar. He should also be asked whether he has had any swelling of his face recently. Since the advent of the antibiotics, physicians sometimes have been inclined to use these drugs on the slightest provocation. As a result, an early acute infection that has been treated with an antibiotic may subside, but remains as a chronic low grade infection, producing pain and making the diagnosis difficult. In any patient with pain about the face or jaws, the cervical nodes should be felt for tenderness or enlargement.

## COMMON CONDITIONS CAUSING PAIN IN THE JAWS

One of the most frequent causes of pain in the jaws is dental caries. Pain may be referred from regions other than the one on which the pa-

well documented with references. All sources are clearly and concisely indicated at the end of each chapter. Printed in Great Britain, the book forgoes the luxury of more than the essential plates, tables, and figures.

—Lt. Col. J. V. Hale, U. S. A. F. (MSC)

*Psychiatry and Catholicism*, by James H. VanderVeldt, O. F. M., Ph. D., Associate Professor of Psychology, Catholic University of America; Professor of Psychology, Trinity College, and Robert P. Odenthal, M. D., F. A. P. A., Director of the Child Center and Assistant Professor of Psychiatry, Catholic University of America. 433 pages. McGraw-Hill Book Co., Inc., New York, N. Y., publishers, 1952. Price \$6.

This is a book on a controversial subject which has been given considerable publicity and generated much heat. Written by professors of clinical psychology and psychiatry at Catholic University, with a foreword by the Archbishop of Washington, it may be considered as the semiofficial Catholic viewpoint. If the reader is willing to accept the authors' implicit assumption that the Catholic viewpoint is the Christian one, he may read this well-written work with equanimity. The authors claim to have no bias against dynamic psychiatry as such, and give Freud due credit, but they do strongly disagree with what they call the "materialistic, deterministic, and hedonistic philosophy" developed by the orthodox Freudian analysts. To quote: "One is frequently unable to find out what is fact, what is psychological theory, and what is philosophical assumption in his writings." Instead they find the existential analysis championed by Frankel more in agreement with their beliefs. "Whereas psychoanalysis is only concerned about making the unconscious id conscious, existential analysis aims at bringing to the conscious level something very different—man's own spiritual existence."

The first part of the book discusses the general principles of dynamic psychiatry assessed by Catholic morality. In the latter portions, the various psychiatric disorders and the implications of psychiatric knowledge in twentieth century living including social work, marriage counseling, and sex education, are discussed. Because the book seems intended primarily for the Catholic clergy and other Catholics working with the mentally ill, pastoral problems are discussed at length. This volume does an excellent job of acquainting such persons with modern developments in psychiatry and should alleviate the prejudices of those who consider any psychiatric approach antithetical to religion. For the non-Catholic it explains the position of those working in the Catholic Church. The book is well printed in an attractive, easily read format.

—Commander F. H. Ocko, MC, U. S. N.

# DIVERTICULUM OF THE DUODENUM<sup>(1)</sup>

EVERETT H. DICKINSON, *Captain, MC, U. S. N.*

CHARLES K. HOLLOWAY, *Lieutenant Commander, MC, U. S. N.*

**D**IVERTICULUM of the duodenum is not an uncommon accidental finding in x-ray clinics during barium meal studies. It is agreed by most surgeons that such a diverticulum, if small and asymptomatic, is not of surgical significance; but if it is large or if signs and symptoms are related to it, surgical removal is the treatment of choice. Complete cure with relief of symptoms may be anticipated.

**Incidence.** Early observers considered duodenal diverticulum to be rare. Maissa (2) in Argentina reported only 1 case in a series of 19,000 roentgenographic examinations and 1 case in another series of 3,400 such examinations. Beals (3) reported an incidence of 2.2 percent in 1,887 consecutive examinations. Of the 41 diverticula found, only 1 patient was operated on. Warren and Emery (4) reported 2.3 percent at Peter Bent Brigham Hospital. Dunstan et al., (5) cited an incidence of 2.2 percent. Ackermann (6) developed a technic for demonstrating duodenal diverticulum with plaster of paris injection of the bowel in the cadaver and found 11 diverticula in 50 subjects. Duodenal diverticulum is most common in patients over 45 years of age. Beals (3) found the average age of 34 patients with such a diverticulum to be 53.3 years, though he did find one in a girl of 16 years. Finney (7) stated that patients between the ages of 60 and 70 years furnish the greatest number of cases. The sex incidence has been found by most authors to be about equal.

**Etiology and pathology.** Although the exact explanation for the development of a duodenal diverticulum is not known, traction, pulsion,

(1) U. S. Naval Hospital, Oakland, Calif.

(2) Maissa, P. A.: Divertículos gastro-duodenales; consideraciones clínico-radiofisiológicas. *Prensa med. argent.* 30: 2014-2024, Oct. 20, 1943; also, *An. Dispens. pub. nac. para enferm. d. ap. digest.* 6: 615-643, 1943.

(3) Beals, J. A.: Duodenal diverticula. *South. M. J.* 30: 218-222, Feb. 1937.

(4) Warren, H. A., and Emery, E. S., Jr.: Duodenal diverticula, with special reference to their symptomatology. *Gastroenterology* 1: 1083-1092, Dec. 1943.

(5) Dunstan, E. M.; Lowance, M. L.; and Jones, E. C.: Clinical importance of duodenal diverticula. *South. M. J.* 42: 460-467, June 1949.

(6) Ackermann, W.: Diverticula and variations of duodenum. *Ann. Surg.* 117: 403-413, Mar. 1943.

(7) Finney, J. M. T., Jr.: Duodenal diverticula; their significance and treatment. *South. Surgeon* 11: 543-554, Aug. 1942.

rest, proper diet, and avoidance of large meals. Surgical intervention is generally recommended for a diverticulum which produces symptoms indicative of moderate to severe inflammation. Early operation in such a situation will prevent perforation, peritonitis, and hemorrhage.

*Operative technic.* Ferguson and Cameron (15) recommended inversion of the pouch and simple closure of the muscular ring. In a patient with a small diverticulum of limited accessibility this is a satisfactory solution. Mahorner and Kisner (16) advised the complete removal of the pouch if possible. Often the common bile duct and pancreatic duct may be so situated as to make complete extirpation unfeasible, in which case simple inversion, provided it does not produce the possibility of obstruction, is the treatment of choice. Positive identification of the sac may be difficult if the diverticulum is small and buried between the leaves of the mesentery. Mahorner and Kisner (16) have devised a method of insufflation of the duodenum with air from an indwelling duodenal tube. This is said to facilitate identification of the pouch. Peatse (17) has advised a technic in which he mobilizes the duodenum to the left and dissects out the diverticulum to the right. MacLean on occasions has used a transduodenal approach with success when the diverticulum could not otherwise be identified and mobilized. A catheter may be inserted into the common bile duct from above for identification in such cases. The third and fourth portions of the duodenum have been approached by MacLean (10) from below by mobilizing the transverse colon and its mesentery, taking care not to disturb the middle colic artery.

#### CASE REPORT

A 57-year-old man was admitted to this hospital on 5 April 1950 complaining of painful fullness of the epigastrium, unpleasant gaseous eructations, and occasional nausea but no vomiting after meals. He described the pain as gradual in onset and becoming severe in the area to the right of the epigastrium. The pain radiated through to his back on the right side. His gastrointestinal symptoms dated back 10 years when he was hospitalized for a severe, prolonged illness with similar signs and symptoms. He stated that his abdomen was quite sore and tender for several weeks and that he had a severe episode of constipation unrelieved by enemas. He was confined for 5 months with this illness which his doctor described as a "nervous breakdown." There was no history of melena, hematemesis, or extreme weight loss. Gastrointestinal upsets of a milder nature were present until the present episode, which seemed to have been brought on by a rather

(15) Ferguson, L. K., and Cameron, C. S., Jr.: Diverticula of stomach and duodenum; treatment by invagination and suture. *Surg., Gynec. & Obst.* 84: 293-300, Mar. 1947.

(16) Mahorner, H., and Kisner, W.: Diverticula of duodenum and jejunum, with report of new technical procedure to facilitate their removal and discussion of their surgical significance. *Surg., Gynec. & Obst.* 85: 607-622, Nov. 1947.

(17) Peatse, H. E.: Surgical management of duodenal diverticula. *Surgery* 15: 705-712, May 1944.



Figure 1. Roentgenogram taken with the patient standing. A gas-filled diverticulum with a residuum of barium is to be seen in the right upper abdominal quadrant. Figure 2. Roentgenogram taken with patient lying down. The barium has gravitated to a dependent position.



past history indicated that on 30 August he had fallen to the ground from a second story porch. Immediately following the fall he noticed that he was completely paralyzed from the waist down. On admission to the civilian hospital a spinal manometric study showed a complete block of the spinal canal with a sensory level found at about the ninth thoracic segment. On 31 August a decompression was performed by removing the lamina completely from the fifth, sixth, seventh, and eighth thoracic vertebrae. The dura was found to be lacerated in both lateral recesses and the spinal cord appeared to be completely severed at the level of the seventh thoracic vertebra. An uneventful recovery was made from this operation.

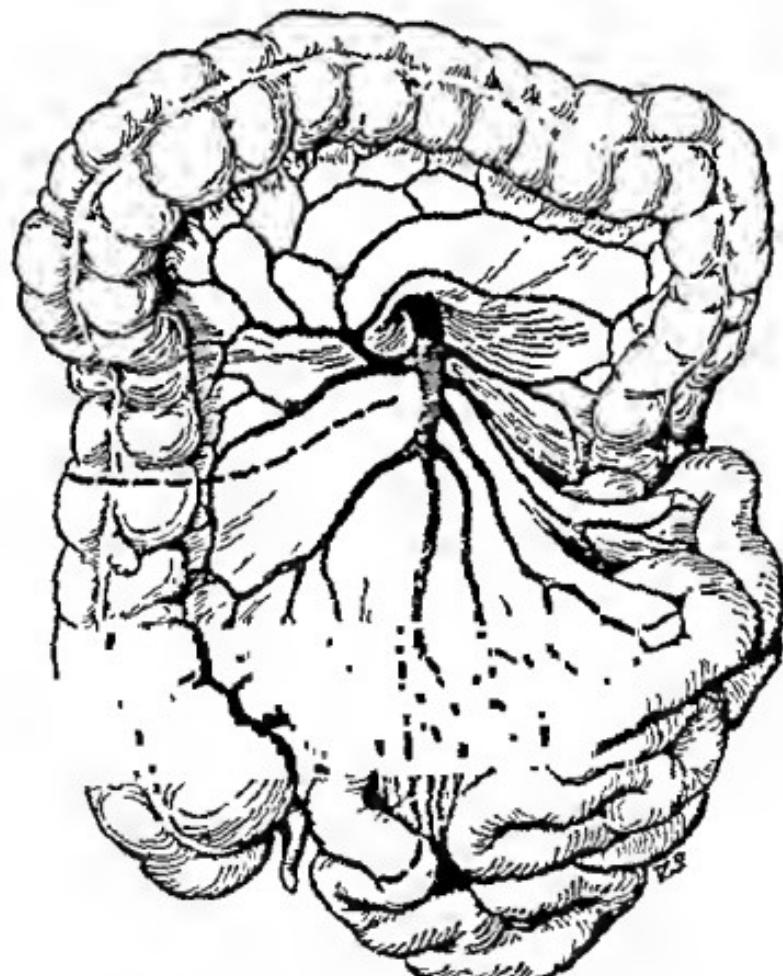
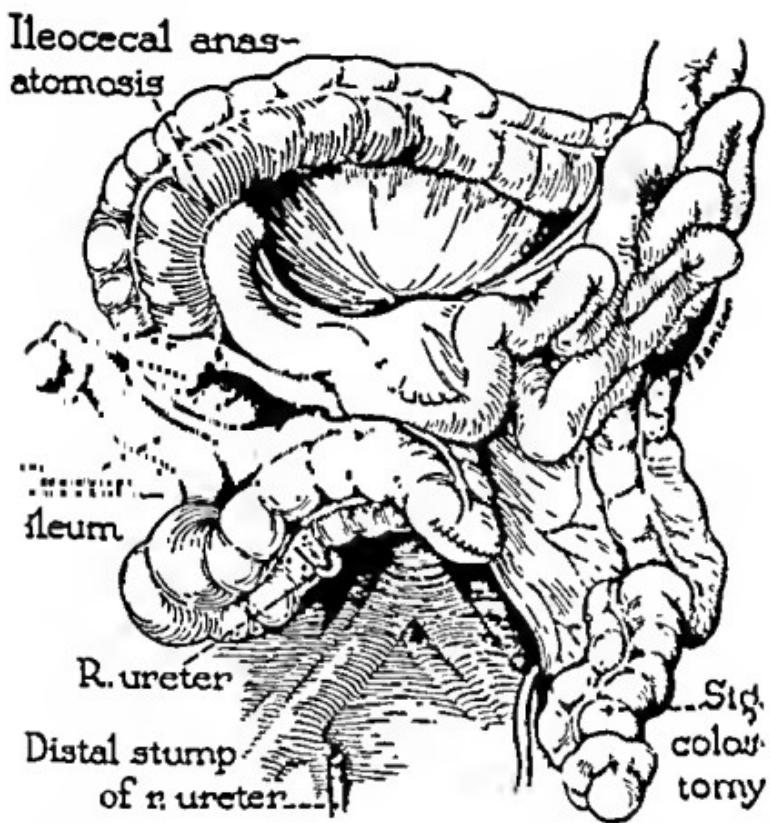


Figure 1. Demonstration of lines of section of bowel and mesentery in formation of substitute bladder and urethra. In practice the colon should be sectioned at or near the hepatic flexure. (Reprinted by courtesy of *Surgery, Gynecology and Obstetrics*. See footnote reference (2).)

On admission to this hospital the patient had complete motor and sensory loss at a level of the eighth thoracic vertebra. Treatment was directed toward care of the neurogenic bladder, prevention of decubitus ulcers, and prevention of contracture of the lower extremities. He was treated daily with passive exercises and whirlpool baths. The bladder



*Figure 2. Ileocolostomy is performed to re-establish bowel continuity. The substitute bladder is swung downward to the left to lie transversely at the pelvic brim and the ureters are transplanted to it. The formation of a colostomy which might be necessary in the resection of an extensive pelvic malignancy is also shown. (Reprinted by courtesy of Surgery, Gynecology and Obstetrics. See footnote reference (2).)*

was irrigated hourly through an indwelling Foley urethral catheter with dilute potassium permanganate solution. Antibiotics were given to prevent secondary infections. In spite of these measures the patient developed severe chills and fever, the temperature rising to about 103° F. daily for 2 weeks. Aureomycin, chloramphenicol, penicillin, and gantrisin were all tried with no success. It was thought that this was a urethral reaction due to the indwelling catheter.

The author seems unnecessarily to oppose the concepts of conflict and the unconscious. His plea for more investigation, correlation of interrelated disciplines, and clarification of vocabulary is sound. From the viewpoint of his contributions to theory we shall be grateful to him, but we would hardly wish to take his gifts at the price of losing those aspects of our psychoanalytic heritage which he condemns and decries.

—*Lt. (j.g.) E. A. Loomis, Jr., MC, U. S. N. R.*

*Surgery of the Chest, A Handbook of Operative Surgery*, by Julian Johnson, M. D., D. Sc. (Med), Professor of Surgery, School of Medicine and Graduate School of Medicine, University of Pennsylvania, and Charles K. Kirby, M. D., Assistant Professor of Surgery, School of Medicine, University of Pennsylvania. Illustrated by Edna Hill. 387 pages, illustrated. The Year Book Publishers, Inc., Chicago, Ill., 1952. Price \$9.

The authors have presented a step-by-step description of the technical details of established thoracic surgical procedures. Essentially all of the common thoracic operations are described clearly and concisely in this small volume. Throughout the book, in describing operative procedures, the text has been placed on one page and the illustrations of that particular operation on the facing page. This arrangement is convenient and greatly facilitates a clear understanding of the procedure being discussed.

The first 54 pages deal with the surgical physiology of the thorax, diagnostic measures employed in evaluating surgical disorders of the chest, evaluation of the general condition of the patient, pulmonary function tests, preoperative and post-operative care, and general operative considerations. It is impossible to discuss these subjects thoroughly in so little space and the necessity or desirability of attempting to do so in a manual that is avowedly devoted to surgical technic is doubtful. Most of the material in this opening chapter could have been omitted without detracting from the merits of the book.

Succeeding chapters deal with chest injuries, operations for empyema and lung abscess, thoracic incisions, and the surgical anatomy of the lungs. There follow chapters on various pulmonary resections, including pneumonectomy, lobectomy, segmental resection; special problems, including cardiac arrest, which may arise during major thoracic procedures; operations on the esophagus, the heart and great vessels, and the lungs in patients with pulmonary tuberculosis; and miscellaneous thoracic operations. The technical descriptions comprise the meat of the book and almost without exception the operations are authoritatively described and clearly illustrated. Because the surgical

treatment of pulmonary tuberculosis is practically a specialty in itself, the wisdom of devoting 2 pages to the selection of patients with pulmonary tuberculosis for surgical treatment must be questioned. A problem of such complexity deserves much more detailed consideration than could possibly have been given it in a volume of this type.

This book will be of the greatest value to students, to practitioners who wish to acquire an understanding of the various thoracic surgical procedures, and to qualified general surgeons who are undertaking training in the specialty of thoracic surgery. The volume is well printed, adequately indexed, and free of typographic errors.—*Capt. C. F. Storey, MC, U. S. N.*

**Ambulatory Proctology,** by *Alfred J. Cantor, M. D., Proctologist, Kew Gardens General Hospital, Long Island, N. Y.; Formerly Assistant Attending Gastroenterologist, Queens General Hospital; Assistant Adjunct Proctologist, Hospital for Joint Diseases, New York, with a Foreword by Beaumont S. Cornell, M. D., Editor, American Journal of Digestive Diseases.* 2d edition, revised. 563 pages; 382 illustrations. *Paul B. Hoeber, Inc., New York, N. Y., publisher, 1952. Price \$10.*

This book supports the current trend toward early ambulation even after major operations. As the title would suggest, the diagnosis and treatment of diseases of the anus, rectum, and sigmoid without confining the patient to bed is the primary objective. It is completely attained, in large part due to the mechanical ingenuity and creative ability of the author. Even radical proctologic surgical technics are described and illustrated, and ambulation in patients on whom these technics have been used is advocated and made possible, no doubt, by the use of oil-soluble anesthetics, the newer hemostatic agents, and antibiotics.

An entire chapter is devoted to the thermal cutting unit and another to the treatment of pruritus ani with the reciprocating hand piece and flexible shaft tattoo instrument designed by the author. Although the chapters on ulcerative colitis and the dysenteries leave much to be desired from the standpoint of the gastroenterologist, they are well written for the proctologist. This book is well illustrated and the bibliography at the end of each chapter is complete.

—*Commander L. J. Pope, MC, U. S. N.*

**Physical Diagnosis,** by *Harry Walker, M. D., F. A. C. P., Professor of Clinical Medicine, Medical College of Virginia, Richmond, Va.* 461 pages; illustrated. *The C. V. Mosby Co., St. Louis, Mo., publisher, 1952. Price \$8.*

The author, with the help of other faculty members of the Medical College of Virginia, has produced an excellent book on physical diagnosis, notable for its clear writing and compete-

by Sylwan (3). This seems rather strange as several examples of this injury associated with epileptic convulsions have been cited. Thomas (4) reviewed 7 cases with posterior dislocation of the shoulder and found that 4 of these occurred during an epileptic convulsion. Of these, 3 had associated fractures of the humeral head. Sylwan in his series, postulated the injury to be due to spasm of the muscles about the shoulder joint. This is further borne out in Thomas's patients who were



Figure 1. Anteroposterior view of the left shoulder showing a compression fracture of the head of the humerus without visible damage to the glenoid cavity. The dislocation cannot be seen. Figure 2. Lateral view of the left shoulder showing the posterior dislocation of the head of the humerus with the fractured portion of the humeral head overriding the posterior rim of the glenoid cavity.

lying in bed at the time of seizure and persons in attendance denied any external trauma to the shoulder. Sylwan further suggested that the fractures of the head of the humerus were a result of the posterior dislocation of the shoulder in which the head of the humerus was forced against the posterior edge of the glenoid cavity by powerful muscle spasm. He was unable to confirm this, however, as none of his patients presented roentgenographic evidence of dislocation.

Our case substantiates Sylwan's latter suggestion. Roentgenograms of the shoulder showed clearly that the humerus was dislocated posteriorly and the fractured portion was in direct contact with the posterior rim of the glenoid cavity. Apparently the fracture was produced by the medial surface of the head of the humerus being forced against the rim of the glenoid cavity which showed no evidence of damage. No other fractures of the humerus were present. The cause of the dislocation most probably was due to muscular contraction though the possibility of added force supplied by the restraining assistant cannot be eliminated.

(3) Sylwan, T.: Impression fractures in caput humeri in connection with electroshock. *Acta radiol.* 32: 455-460, 1942.

(4) Thomas, M. A.: Posterior subacromial dislocation of head of humerus. *Am. J. Roentgenol.* 37: 767-773, June 1937.

# REFRACTIVE ERRORS IN ORIENTAL AND CAUCASIAN TRAINEES

MILTON BRAVEMAN, *First Lieutenant, MSC, U. S. A. (1)*

**T**HIS survey is based almost entirely on the eye examinations of trainees at the Hawaiian Infantry Training Center. The relatively high incidence of Oriental trainees compared to that found at other basic training centers afforded the opportunity to compare their eyes with those of Caucasian trainees.

The average age of our patients was 21 years. They were either soldiers with reduced visual acuity in either eye or soldiers with complaints suggestive of ocular disease. A low grade of hyperopia is present in most trainees. These men have little or no visual or ocular difficulties and, hence, their eyes are not examined. The comparison of the eyes of Caucasian and Oriental soldiers which follows should not, therefore, be construed as representative of the general refractive findings of either race, but only as a comparison of the eyes requiring glasses.

In determining the requirements for glasses, SR 40-340-5 was closely adhered to. This special regulation denies (with some exceptions) spectacles to patients with a myopia or an astigmatism of less than 0.5 diopter and to patients with a hyperopia of less than 1 diopter. The records of about 500 patients of each race were used in compiling the statistics. For uniformity, all prescriptions were expressed in plus cylinder form.

It was found that in spheres (fig. 1), the maximum amount of myopia is about the same for the Oriental and the Caucasian, but on the plus end of the graph, the Caucasian eye is much more prevalent, both in the number with hyperopia and in the severity of the error. Aphakic eyes were not used in the computation. Only 0.8 percent of the Orientals, while 12 percent of the Caucasians given spectacles had more than 1 diopter of hyperopia. Of possible interest from a supply standpoint, the middle 75 percent of the graph for the Caucasians extended from plus 1 to minus 3 diopters while the middle 75 percent of that for the Orientals was slightly more concentrated and shifted to myopia of from minus 0.25 to minus 3.75 diopters.

Probably the most significant finding of the survey is the difference in average sphere prescribed; for the Caucasian, minus 0.99; for the Oriental, minus 1.84 diopters. Were the patients drawn from an older

(1) Tripler Army Hospital, Honolulu, T. H.

age bracket, there would be a shift to less myopia. Also, had a general sample been taken instead of just those with visual or ocular difficulties, there would have been a marked shift of the graph to hyperopia.

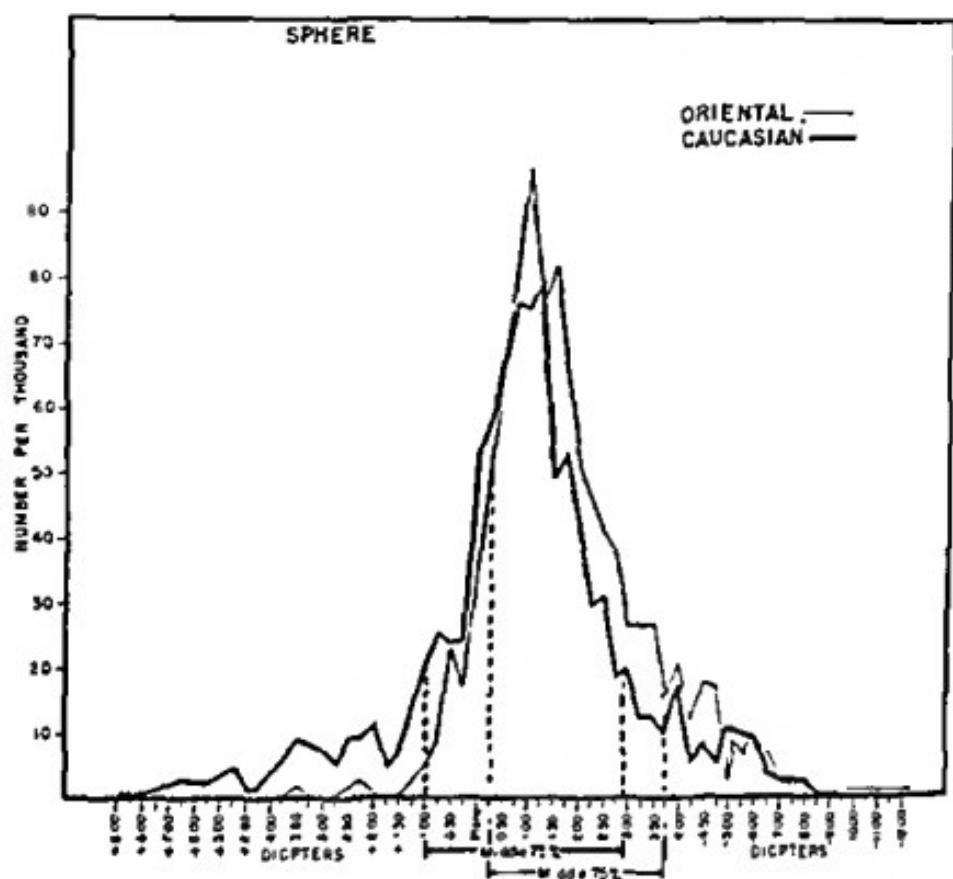


Figure 1. Comparison of spherical correction prescribed for Oriental and Caucasian trainees.

The difference in astigmatic correction was minimal (fig. 2); an average of plus 0.58 and plus 0.67 diopter for the Orientals and the Caucasians respectively. This difference is not sufficient to warrant the assumption that Orientals have less astigmatism than do Caucasians.

Amblyopia was found to be more than 7 times more prevalent among the Caucasians. In the Caucasians amblyopia was due more frequently to an anisometropic hyperopia and in the Orientals it was due more frequently to an anisometropic astigmatism. The Caucasians with amblyopia were predominantly esotropic and in the Orientals exotropia and bilateral fusion were both more common than esotropia.

A greater percent of the Orientals than of the Caucasians had glasses prior to induction. Of the Oriental trainees, 19.7 percent were issued

spectacles and 18.8 percent already had civilian prescriptions. Of the Caucasians, 14.5 percent were given glasses but only 8.6 percent already had civilian prescriptions.

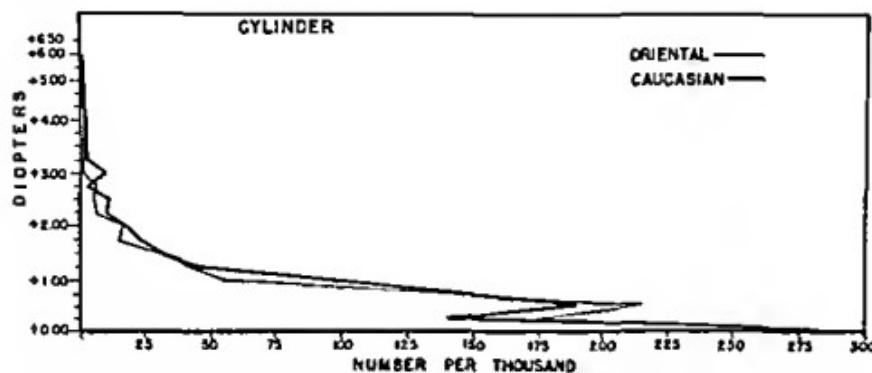


Figure 2. Comparison of cylindrical correction prescribed for Oriental and Caucasian trainees.

### CONCLUSIONS

Oriental trainees are less farsighted, more eye-conscious, and less amblyopic than the Caucasian trainees. The first 2 findings, no doubt, account for the third.

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### BOOK REVIEWS

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The Unipolar Electrocardiogram, A Clinical Interpretation, by Joseph M. Barker, M. D., F. A. C. P., Cardiologist, Yater Clinic; Associate Professor of Clinical Medicine and Special Lecturer in Physiology, Georgetown University School of Medicine; Director of the Heart Station and Visiting Physician, Georgetown University Hospital; Chief of Cardiology, Providence Hospital; Visiting Physician, Gallinger Municipal Hospital; Consulting Cardiologist, Arlington Hospital, Arlington, Va., assisted by Joseph J. Wallace, M. D., F. A. C. P.; advised by Wallace M. Yater, M. D., F. A. C. P. Foreword by Frank N. Wilson, M. D., F. A. C. P. 655 pages; illustrated. Appleton-Century-Crofts, Inc., New York, N. Y., publishers, 1952.

This text, although primarily prepared as a guide to unipolar electrocardiography, is a rather complete text on the general subject of clinical electrocardiography. It consists of 18 chapters and an extensive bibliography and index. It is simply written, profusely illustrated and the material well organized. Much space is given to the discussion of cardiac arrhythmias, but nothing new is added. No mention is made of the more recent

and generally accepted unitary theory of supraventricular arrhythmias. The author makes some original observations regarding bundle branch block and right ventricular hypertrophy. The principles and precepts in general are those of Dr. Frank N. Wilson, under whom the author received his training in electrocardiography. This text can be recommended for both the student and the practicing physician. The chapters devoted to the electrocardiographic features of myocardial infarction, ventricular hypertrophy, and conduction disturbances in the ventricles are well prepared and constitute the chief contribution of this excellent text.

—*Col. T. W. Mattingly, MC, U. S. A.*

**Physical Medicine in General Practice**, edited by William Bierman, M. D., Attending Physician, Department of Physical Medicine, Mount Sinai Hospital, New York, N. Y., Assistant Clinical Professor of Medicine, Columbia University, and Sidney Licht, M. D., Lecturer, Physical Medicine, Tufts College Medical College and Boston University School of Medicine; Instructor, Boston School of Occupational Therapy, with 22 contributors. 3d edition. 793 pages, illustrated. Paul B. Hoeber, Inc., New York, N. Y., publisher, 1952. Price \$12.50.

This is a comprehensive, up-to-date, and easily understood clinical presentation of a medical specialty and it is of interest to the general practitioner, internist, and surgeon. It is adequately indexed and presents an extensive bibliography. The first 500 pages are devoted to the human body's (1) physiologic response, (2) systemic and local changes, (3) reflex action, (4) vasomotor tone, (5) blood-flow changes, (6) local and systemic pressure changes, (7) metabolic and chemical changes, and (8) therapeutic uses of the various physical modalities. Heat and cold, hydrotherapy, climatherapy and spa therapy, visible and infrared radiation, diathermy, surgical diathermy, galvanic and low frequency current, ultraviolet radiation, ultrasound, massage, manipulation, functional muscle testing, exercise, occupational therapy, and medical rehabilitation are each discussed separately and in adequate detail.

The rest of the book takes up the clinical application of physical measures to (1) diseases of the locomotor system, (2) arthritis and rheumatic diseases, (3) the lower extremity amputee, (4) neurologic diseases, (5) anterior poliomyelitis, (6) neuromuscular re-education of paralyzed muscles, (7) cardiovascular diseases, (8) diseases of the digestive system, (9) genitourinary diseases, (10) gynecologic diseases, (11) eye, ear, nose, and throat diseases, (12) respiratory diseases, and (13) dermatologic diseases.—*Col. A. E. White, MC, U. S. A.*

# SEXUAL PRECOCITY

HARRY J. UMLAUF, Jr., Major, MC, U. S. A. (1)

CONN L. MILBURN, Jr., Colonel, MC, U. S. A. (1)

**T**HIS report concerns 2 male siblings, ages 1½ and 2½ years, with constitutional precocious sexual development and an extensive family history of the condition. Isolated cases of this type have been reported, but in only 5 previous reports has this disorder appeared to be familial (2-6). (Editor's note: In Pediatrics, Vol. 9, pp. 682-695, June 1952, A. W. Jacobsen and M. T. Macklin, in an article entitled "Hereditary Sexual Precocity," report a family with 27 affected male members.) Most of the case reports (7-10) concern female rather than male precocity. Some of our standard texts describe the onset of the precocious sexual characteristics as usually occurring at the age of 5 or 6 years. Both of our patients showed evidence of premature sexual development at the age of 9 months.

## CASE REPORTS

*Case 1.* The younger sibling, an 18-month-old boy (fig. 1), had a normal prenatal and neonatal history. His growth and development appeared normal until he was 9 months old when pubic hair was noted and his genitalia appeared large for his age. At the age of 18 months, when he was admitted to this hospital, his penis was 4 inches long in the flaccid state, his testes were commensurate in size to the penis, and his prostate was readily palpable. He weighed 34 1/4 pounds and was 36 1/4 inches tall.

(1) Letterman Army Hospital, San Francisco, Calif.

(2) Egstrom, W. W., and Mason, P. L.: Precocious sexual and somatic development in boys due to constitutional and endocrine factors. Am. J. Dis. Child. 81: 179-192, Feb. 1951.

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(9) Lowrey, G. H., and Brown, T. G.: Precocious sexual development; a study of 30 cases. J. Pediat. 38: 325-340, Mar. 1951.

(10) Reubin, M. S., and Manning, G. R.: Precocious puberty. Arch. Pediat. 39: 769-785, Dec. 22, 1922.

His build was stocky and muscular and his size was that of an average boy of about 3 9/12 years. The remainder of the physical (including a neurologic) examination was negative. His 17-ketosteroids level was 1.3 mg. per 24-hour urine specimen. The urine assay for follicle-stimulating hormone (FSH) revealed less than 6 mouse units per 24 hours, and a semen smear was negative for sperms. Roentgenograms of the skull showed extensive



Figure 1.



Figure 2.

pneumatization of the mastoid areas bilaterally and, to a lesser degree, pneumatization of the sphenoid sinus. A roentgenogram of the wrists revealed the presence of the triangularis, not normally seen until the fourth year.

*Case 2.* The older sibling, a 30-month-old boy (fig. 2), had a history similar to that of his younger brother. The prenatal and neonatal courses were normal. His growth and development were

also normal until he was 9 months old when pubic hair was noticed. When he was 12 months old, his mother noted that his penis was extremely large and when he was 30 months old, he had begun to masturbate regularly, had the ability to ejaculate, and exhibited a marked interest in members of the opposite sex.

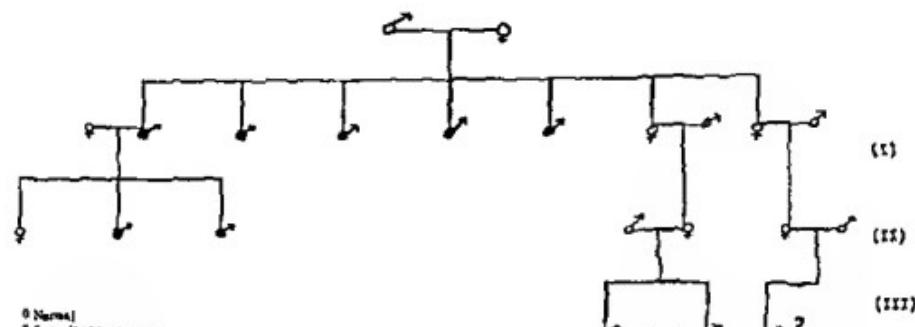


Figure 3. Idiopathic precocious sexual development in male members of three generations

At that time his height was 42% inches, and his weight was 44 pounds. He had a stocky and muscular physique and his size was that of an average boy of 5 years. A small amount of black pubic hair was present. His penis was 4 inches long in the flaccid state, his testes were fully developed, and his prostate was easily palpated. The neurologic examination was negative. His 17-ketosteroids level was 2.3 mg. and the FSH assay was less than 6 mouse units per 24-hour urine specimen. Roentgenograms of his skull showed extensive pneumatization of the mastoid area bilaterally, and one of his wrists showed ossification centers for all carpal bones with the exception of the left pisiform. The center for the left distal ulnar epiphysis was also visualized. Roentgenograms of the lower extremities showed epiphyses for the trochanters although those for the lesser trochanters ordinarily do not appear until about the ninth year.

Figure 3 shows the familial tendency to sexual precocity in this family. Two uncles and 5 great uncles had precocious sexual development and 1 first cousin was reported to be quite large for his age, both physically and sexually.

## DISCUSSION

These patients were considered unusual because of the early onset of sexual development, and because in only 5 previous reports has this condition appeared to be familial. No treatment is indicated other than the psychologic management of the parents and the boys. The parents were assured that the boys

The author seems unnecessarily to oppose the concepts of conflict and the unconscious. His plea for more investigation, correlation of interrelated disciplines, and clarification of vocabulary is sound. From the viewpoint of his contributions to theory we shall be grateful to him, but we would hardly wish to take his gifts at the price of losing those aspects of our psychoanalytic heritage which he condemns and decries.

—Lt. (jg.) E. A. Loomis, Jr., MC, U. S. N. R.

*Surgery of the Chest, A Handbook of Operative Surgery*, by Julian Johnson, M. D., D. Sc. (Med), Professor of Surgery, School of Medicine and Graduate School of Medicine, University of Pennsylvania, and Charles K. Kirby, M. D., Assistant Professor of Surgery, School of Medicine, University of Pennsylvania. Illustrated by Edna Hill. 387 pages, illustrated. The Year Book Publishers, Inc., Chicago, Ill., 1952. Price \$9.

The authors have presented a step-by-step description of the technical details of established thoracic surgical procedures. Essentially all of the common thoracic operations are described clearly and concisely in this small volume. Throughout the book, in describing operative procedures, the text has been placed on one page and the illustrations of that particular operation on the facing page. This arrangement is convenient and greatly facilitates a clear understanding of the procedure being discussed.

The first 54 pages deal with the surgical physiology of the thorax, diagnostic measures employed in evaluating surgical disorders of the chest, evaluation of the general condition of the patient, pulmonary function tests, preoperative and post-operative care, and general operative considerations. It is impossible to discuss these subjects thoroughly in so little space and the necessity or desirability of attempting to do so in a manual that is avowedly devoted to surgical technic is doubtful. Most of the material in this opening chapter could have been omitted without detracting from the merits of the book.

Succeeding chapters deal with chest injuries, operations for empyema and lung abscess, thoracic incisions, and the surgical anatomy of the lungs. There follow chapters on various pulmonary resections, including pneumonectomy, lobectomy, segmental resection; special problems, including cardiac arrest, which may arise during major thoracic procedures; operations on the esophagus, the heart and great vessels, and the lungs in patients with pulmonary tuberculosis; and miscellaneous thoracic operations. The technical descriptions comprise the meat of the book and almost without exception the operations are authoritatively described and clearly illustrated. Because the surgical

treatment of pulmonary tuberculosis is practically a specialty in itself, the wisdom of devoting 2 pages to the selection of patients with pulmonary tuberculosis for surgical treatment must be questioned. A problem of such complexity deserves much more detailed consideration than could possibly have been given it in a volume of this type.

This book will be of the greatest value to students, to practitioners who wish to acquire an understanding of the various thoracic surgical procedures, and to qualified general surgeons who are undertaking training in the specialty of thoracic surgery. The volume is well printed, adequately indexed, and free of typographic errors.—*Capt. C. F. Storey, MC, U. S. N.*

**Ambulatory Proctology**, by *Alfred J. Cantor, M. D.*, Proctologist, New Hyde Park General Hospital, Long Island, N. Y.; Formerly Assistant Attending Gastroenterologist, Queens General Hospital; Assistant Adjunct Proctologist, Hospital for Joint Diseases, New York, with a Foreword by *Beaumont S. Cornell, M. D.*, Editor, American Journal of Digestive Diseases. 2d edition, revised. 563 pages; 382 illustrations. Paul B. Hoeber, Inc., New York, N. Y., publisher, 1952. Price \$10.

This book supports the current trend toward early ambulation even after major operations. As the title would suggest, the diagnosis and treatment of diseases of the anus, rectum, and sigmoid without confining the patient to bed is the primary objective. It is completely attained, in large part due to the mechanical ingenuity and creative ability of the author. Even radical proctologic surgical technics are described and illustrated, and ambulation in patients on whom these technics have been used is advocated and made possible, no doubt, by the use of oil-soluble anesthetics, the newer hemostatic agents, and antibiotics.

An entire chapter is devoted to the thermal cutting unit and another to the treatment of pruritus ani with the reciprocating hand piece and flexible shaft tattoo instrument designed by the author. Although the chapters on ulcerative colitis and the dysenteries leave much to be desired from the standpoint of the gastroenterologist, they are well written for the proctologist. This book is well illustrated and the bibliography at the end of each chapter is complete.

—*Commander L. J. Pope, MC, U. S. N.*

**Physical Diagnosis**, by *Harry Walker, M. D., F. A. C. P.*, Professor of Clinical Medicine, Medical College of Virginia, Richmond, Va. 461 pages; illustrated. The C. V. Mosby Co., St. Louis, Mo., publisher, 1952. Price \$8.

The author, with the help of other faculty members of the Medical College of Virginia, has produced an excellent book on physical diagnosis, notable for its clear writing and complete-

cess. It would appear to be especially valuable for medical students because such basic subjects as the clinical thermometer and the technic of percussion, are described in great detail. The significance of usual physical signs and symptoms is pointed out in simple language. In addition, note is made of the fact that night sweats are not helpful in the diagnosis of tuberculosis, that duskeness of the infraorbital areas does not indicate disease, et cetera. Besides 23 chapters on the usual physical examination in proper sequence, there are special chapters on the diagnosis of female pelvic disease and neurologic and psychiatric examination. The last section of the book describes the pathology, physical signs, and diagnosis of diseases of the respiratory tract and circulatory system. For the medical student and intern this section should prove especially valuable because theoretical discussion has been practically eliminated and only essential facts are given. The illustrations are excellent and greatly aid in the understanding of the text.

—Col. W. H. Diessner, MC, U. S. A.

*Gastrointestinal X-ray Diagnosis*, by Max Rizzo, M. D., Assistant Professor of Radiology, Harvard Medical School; Instructor in Radiology, Tufts Medical School; Director, Department of Radiology, Boston City Hospital; Associate in Radiology, Beth Israel Hospital, Boston, Mass., and I. A. Schaffer, M. D., Instructor in Radiology, Harvard Medical School; Instructor in Radiology, Tufts Medical School; Visiting Radiologist, Boston City Hospital. 838 pages, 470 illustrations, 2 in color. Lea & Febiger, Philadelphia, Pa., publishers, 1952. Price \$20.

This is an excellent reference book, not only for the roentgenologist, but for the surgeon and internist as well, providing for each a means of understanding the problems of the others. Not only are roentgenologic methods of diagnosis discussed in detail, according to findings relative to each organ of the gastrointestinal system, but the anatomy, embryology, and physiology are reviewed in each instance. The lesions of each part are described in detail, including clinical signs and symptoms, methods of roentgenologic examinations and pertinent findings, differential diagnosis, and accepted therapy. The arrangement of subject material follows a well-established pattern and the presentation, though detailed, is clear, concise, and practical with a minimum of ambiguity and a minimum of discussions of unproved theory. Although the amount of detail precludes reading for pleasure, the phrasing and terminology is such that understanding of the subject matter is easily within the grasp of any physician. There is an interesting treatise on the history and development of roentgenologic methods of gastrointestinal diagnosis. The illustrations are superior, both in choice and reproduction. The bibliography at the end of each discussion is extensive and should be of great assistance to the specialist.

—Lt. J. H. Lawson, MC, U. S. N.



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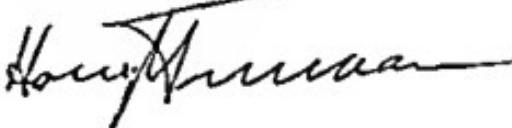
October 1, 1952

Dear General Armstrong:

The 59th annual meeting of the Association of Military Surgeons of the United States in Washington, D. C., November 17th to 19th, is a timely reminder of the vital role that military medicine plays in our efforts to preserve freedom throughout the world. In Korea today many men and women of both the reserve and regular federal health services are unselfishly devoting their skill and energy, and sacrificing their lives, on behalf of our sick and wounded soldiers, sailors and airmen.

In view of the great significance of this forthcoming meeting, which is dedicated to the health and welfare of our fighting forces, the American people join me in extending to you, to all the members of your association, and to your honored guests from abroad most sincere good wishes.

Very sincerely yours,



Major General Harry G. Armstrong,  
Surgeon General, United States Air Force,  
President, Association of Military  
Surgeons of the United States,  
Department of Defense,  
Washington 25, D. C.

VOL. III

NOVEMBER 1952

NO. 11

# UNITED STATES ARMED FORCES MEDICAL JOURNAL

*Published Monthly by the Armed Forces Medical Publication  
Agency, Department of Defense*



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THE PRINTING OF THIS PUBLICATION HAS BEEN APPROVED BY  
THE DIRECTOR OF THE BUREAU OF THE BUDGET, OCT. 19, 1949

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UNITED STATES  
GOVERNMENT PRINTING OFFICE  
WASHINGTON 1952

For sale by the Superintendent of Documents, U. S. Government Printing Office  
Washington 25, D. C. Price 45 cents (single copy). Subscription price  
\$5.25 a year; \$1.25 additional for foreign mailing.

# FOREWORD

The *United States Armed Forces Medical Journal* is the medium for disseminating information of administrative and professional interest to all medical personnel of the Department of Defense. The Chairman of the Armed Forces Medical Policy Council and the Surgeons General of the several services invite all medical officers, dental officers, Medical Service Corps officers, Nurse Corps officers, and officers of the Veterinary Corps of the Armed Forces, and the medical consultants of the Army, Navy, and Air Force to submit manuscripts for publication in this Journal.

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The summary should be a factual and brief recapitulation of the observations or statements contained in the article. The conclusions drawn from the case, experiment, or facts set forth should be clearly stated and should appear at the close.

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*United States Army.*

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*United States Air Force.*

BENNETT F. AVERY, *Associate Editor,*  
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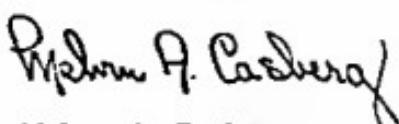
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## Monthly Message

Since early times warriors have used protective devices ranging from the simple shield of the jungle savage to the complicated total body armor of the knights of the Middle Ages. The relatively stable trench warfare of World War I was symbolized by the steel helmet, whereas the mere fluid and mobile combat actions observed in recent hostilities have resulted in the development of group protective body armor as exemplified by the modern tank or the encircling steel apron of the naval gun as well as the individual protective flak vests of our airmen.

Studies in wound ballistics reveal that a rather constant major proportion of body injuries incurred in combat are due to shell fragments. Comparisons of body area wound statistics of the Korean conflict with those of World War II show only minor variations and reveal that about 20 percent of the wounds incurred in action are caused by high velocity missiles, the remaining 80 percent being the result of lower velocity shell fragments. About 25 percent of those wounded in action sustain injuries of the chest and abdomen. In this portion the ultimate case fatality rate is much higher and many more hours of valuable surgical team time are required per case than in the 60 percent incurring wounds of the extremities.

Any further reduction in the casualty rate must lie in the use of some type of body armor. The Armed Forces Medical Policy Council has been keenly interested in the development of a practical protective element of value to those exposed to the hazards of open combat and has given policy support to the tests of body armor being conducted by the Marines in Korea. Certain minor problems, such as the adequacy of body area coverage, the possibility of further reduction in weight, and the generation of excessive body heat, are in the process of solution. This added protective equipment has been well received by the combat soldier as reflected in the reply of a marine in combat, when queried about wearing it even with the temperature well over 100° F., "Doc, I'd rather drip sweat than drip blood."



Melvin A. Casberg, M. D., Chairman  
Armed Forces Medical Policy Council  
Office of the Secretary of Defense

# OXYGEN VS. OXYGEN-CARBON DIOXIDE IN RESUSCITATION<sup>(1)</sup>

DAVID B. DILL, Ph. D.

THE advisability of adding carbon dioxide to oxygen for resuscitation has been debated for more than 30 years. In the case of resuscitation from carbon monoxide poisoning an affirmative recommendation was made in 1923 by a Commission appointed at the request of the American Gas Association (2). The Commission was composed of 9 eminent physiologists and experts in clinical medicine, including as chairman, C. K. Drinker. Two of the physiologist members, Henderson and Haggard, had advocated the use of such a mixture for several years prior to the authoritative endorsement by the Commission. The Commission condemned the "pulmator" and "lungmotor," preferring manual artificial respiration by the Schafer prone pressure method, if breathing had stopped. The Henderson-Haggard "inhalator," using 5 percent carbon dioxide in oxygen, was approved (3).

Although some members of the Commission subsequently reached different conclusions, Henderson never wavered. His vigorous arguments were reiterated in 1938 (4) and again in 1943 (5). The most desirable concentration of carbon dioxide was investigated by Drinker and his associates. The results, summarized by Drinker (6), led to the adoption of 7 percent carbon dioxide in oxygen. This mixture has become known as "carbogen."

The past 10 years have seen notable advances in the field of artificial respiration. A new manual method has been adopted in this country (7), and several mechanical devices have come into

(1) From the Chemical Corps Medical Laboratories, Army Chemical Center, Md.

(2) Drinker, C. K.; Cannon, W. B.; Edsall, D. L.; Haggard, H. W.; Henderson, L. J.; Henderson, Y.; Peabody, F. W.; Sayers, R. R.; and Scott, C. B.: Final report of commission on resuscitation from carbon monoxide asphyxia; treatment of carbon monoxide asphyxia. *J. Industrial Hygiene* 5: 125-129, 1923-1924.

(3) This apparatus is manufactured by the Mine Safety Appliances Company.

(4) Henderson, Y.: *Adventures in Respiration*. Williams & Wilkins Co., Baltimore, Md., 1938.

(5) Henderson, Y., and Haggard, H. W.: *Noxious Gases and the Principles of Respiration Influencing Their Action*. 2d edition. Reinhold Publishing Corporation, New York, N. Y., 1943.

(6) Drinker, C. K.: *Carbon Monoxide Asphyxia*. Oxford University Press, New York, N. Y., 1938.

(7) Dill, D. B.: Manual artificial respiration. *U. S. Armed Forces M. J.* 3: 171-184, Feb. 1952.

use. In 1944 the Council of Physical Medicine of the American Medical Association published the following (8):

"Included in the Council's list of accepted devices are inhalators and resuscitators, the two types of apparatus for administering mechanical artificial respiration. These devices are often confused as to function; the following briefly describes them:

"Inhalators provide an atmosphere of oxygen and carbon dioxide gas mixture slightly higher than atmospheric pressure around the mouth and nose of the victim and are used in conjunction with an approved method of manual artificial respiration. Inhalators consist essentially of a face piece, rubberized fabric breathing bag, pressure reducing valve, tanks of carbon dioxide-oxygen mixture and carrying case.

"Resuscitators create (either) positive and negative pressure by means of a mechanical appliance operated by the energy of the stored gas (or) merely (intermittent) positive pressure only. A face piece, reduction valve, tanks of carbon dioxide-oxygen mixture or merely tanks of oxygen, a carrying case, and a reciprocating mechanism are the principal parts of the resuscitator.

"The efficacy of the two types of appliances has been shown to be essentially the same by the evidence coming to the Council. Records show that when an inhalator and a resuscitator are on the scene of an accident at the same moment, and if either one is employed efficiently, the final result will not differ."

During this 10-year period many experts in anesthesia have come to doubt the soundness of adding carbon dioxide to oxygen for resuscitation, even in carbon monoxide poisoning. In 1947 Adriani (9) made the following recommendation:

"Do not add carbon dioxide to the oxygen mixture. The use of carbon dioxide for respiratory failure is a controversial subject. Do not worry if it is not available. Oxygen is the gas which must be introduced into the alveoli."

### COMPARISON OF OXYGEN AND CARBOGEN

It remained for Schwerma et al. (10, 11) to settle some of these questions beyond reasonable doubt. In one study (10) 310 dogs

(8) Artificial respiration—manual and mechanical, report of Council on Physical Medicine. J. A. M. A. 126: 835, Nov. 25, 1944.

(9) Adriani, J.: Techniques and Procedures of Anesthesia. Charles C Thomas, Publisher, Springfield, Ill., 1947.

(10) Schwerma, H.; Ivy, A. C.; Friedman, H.; and LaBrosse, E.: Study of resuscitation from justlethal effects of exposure to carbon monoxide. Occup. Med. 5: 24-43, Jan. 1948.

(11) Schwerma, H.; Ivy, A. C.; and Friedman, H.: Resuscitations from nearly fatal effects of exposure to "pure" carbon monoxide. J. Appl. Physiol. 1: 157-168, Aug. 1948.

were poisoned to the point of gasping respiration with illuminating gas diluted with air and in a similar study (11) on 157 dogs, commercial carbon monoxide diluted with air was used. Two types of mechanical devices (positive-negative and intermittent positive) were used for resuscitation. With the former both oxygen and carbogen were evaluated; with the latter only carbogen was used. The authors concluded that 100 percent oxygen and carbogen were equal in effectiveness. This conclusion was valid for 2 criteria of success (immediate survival and incidence of neurologic injury). The number of dogs used insured statistical validity.

*Expert opinion.* Many physiologists have entered the field of anesthesiology in recent years. They have played a major role in strengthening this science and in narrowing the gap between research in respiratory physiology and its applications in the operating room and in the emergency ward. Hence it seemed appropriate to inquire regarding the use of carbogen in artificial respiration. Such an inquiry was addressed to a number of respiratory physiologists and to several anesthesiologists. Several of both groups have been associated under contract with the military Medical Services or the Chemical Corps in research in the field of respiratory physiology. Excerpts of the views expressed follow:

John S. Gray, Chairman, Department of Physiology, The Medical School, Northwestern University: " \* \* \* it is certainly the opinion of our Physiology Department that pure oxygen is a great deal safer for general resuscitative uses than carbon dioxide-oxygen mixtures. The reasons for this opinion are numerous. In cases where resuscitation is essential, namely, when breathing has stopped entirely, or is quite feeble, anoxemia, hypereapnia, and acidemia (both respiratory and metabolic) are all present. This combination is especially dangerous, because in the presence of respiratory center depression (from oxygen lack certainly, and severe acidemia probably) the hypercapnia is converted to a respiratory inhibitor instead of a stimulator (the well-known "carbon dioxide reversal"). This inhibition by depressing respiration further, aggravates the 3 changes, so that a vicious cycle is set up, which runs a rapidly fatal course. The objective of resuscitation should be to break this vicious cycle, and reverse the chemical disturbances. The inclusion of carbon dioxide in the inhaled mixture at best interferes with this objective, and at worst aggravates the problem. Furthermore, if spontaneous breathing is restored, the body's normal compensation for the surviving metabolic acidosis is to produce acapnia to minimize the pH shift; this objective of nature is likewise interfered with by the inclusion of carbon dioxide. The gradual recognition of the above facts, together with the gradual recog-

nition of the fact that there was never experimental evidence nor rationale to support the use of carbon dioxide in the first place, has lead to a gradual abandonment of the use of carbon dioxide for general resuscitative purposes.

"Opinion is less well crystallized with respect to the use of carbon dioxide in the respiratory support (not restoration of breathing after apnea) in case of carbon monoxide poisoning. Here, there is a possibility that the augmented ventilation and respiratory acidosis may accelerate the elimination of carbon monoxide from the body. But this is an entirely different matter than true resuscitation. Even the carbon monoxide poisoning case, in the acute stage when resuscitation is required, should not be given carbon dioxide; in the recovery stage, it may be used to hasten elimination of the poison."

Robert D. Dripps, Professor of Anesthesiology, The Graduate School of Medicine, University of Pennsylvania: "We prefer 100 percent oxygen, believing that wherever respiratory tidal volume is depressed, arterial blood carbon dioxide will be increased and further addition of carbon dioxide may not only not be stimulant but may even be depressant to the central nervous system. In our own institution we do not even use carbon dioxide and oxygen combinations for the treatment of carbon monoxide poisoning. The only exception to the rule for use of 100 percent oxygen is when a subject does not breathe for many hours or days. Under these circumstances if 100 percent oxygen be administered for excessive lengths of time, oxygen toxicity may occur. We have had this experience in several neurosurgical patients who have required artificial ventilation for days. Under these circumstances we prefer 50 percent oxygen and 50 percent nitrogen."

Henry K. Beecher, Derr Professor of Research in Anesthesia, Anesthetist-in-Chief, Department of Anesthesia, Massachusetts General Hospital, Harvard Medical School: "We use only oxygen here and have even gone so far as to banish carbon dioxide tanks from the emergency wards and operating rooms, lest there be an interchange of tanks, with disastrous results. We do not have the 95 percent oxygen-5 percent carbon dioxide mixtures either. It is my understanding that these percentages do not hold well as the pressure in the tank changes. But far more important than any of these reasons is the fact that we do not find the carbon dioxide necessary nor its use wise in the type of problem which comes into this rather large general hospital. Individuals in respiratory difficulty are almost always suffering (at least in the serious cases) from an excess of carbon dioxide in the tissues and blood. While the expert might occasionally find a rare use for carbon dioxide in conjunction with resuscitation, we do not believe that

it is really necessary nor wise to have it around in a place where we do so much teaching. This reason, of course, is pertinent to the problems that may arise when less than skilled personnel would presumably be carrying out such resuscitation in the event of a national disaster."

Max S. Sadove, Professor of Surgery, Head, Division of Anesthesiology, Research and Educational Hospitals, University of Illinois: " \* \* \* one can easily do without carbon dioxide-oxygen mixtures. It is true that in some special, rare instances such as carbon monoxide poisoning, some have advocated the use of carbon dioxide-oxygen mixtures to aid in the dissociation of the carbon monoxide-hemoglobin link. But, even in these instances, one wonders whether 5 percent is correct, or 3 percent, or what percent is correct.

"I think that when carbon dioxide-oxygen is used, it should be used purely as a therapeutic procedure of an experimental nature or for a specific purpose, but certainly it has no place as a general vehicle for resuscitative measures. In most instances, there is already an excess of carbon dioxide in the body and the further addition of the carbon dioxide would probably do a great deal of harm rather than any good. I can visualize it depressing the central nervous system and in the higher concentrations it may be seen doing damage to the brain and the vascular bed as well."

"I personally would say that as a routine procedure, only oxygen should be attached to resuscitators. True, carbon dioxide may be used for its vasodilation in the cerebral cortex, it may be used intermittently to stimulate respiration, et cetera, but it has no place in the routine resuscitative procedures, with the one possible exception of carbon monoxide poisoning. There I would state that one would be better off having only oxygen available on resuscitators and these rare instances where carbon dioxide is used, attaching it for just that purpose."

Eugene F. DuBois, Emeritus Professor of Physiology, Cornell University Medical College: "Our chief anesthetist \* \* \* tells me that after operations he uses pure oxygen. He has given up 95.5 percent carbon dioxide mixture."

David Grob, Department of Medicine, The Johns Hopkins Hospital: "The procedure at the hospital is to use oxygen rather than oxygen-carbon dioxide mixtures for resuscitation purposes, with the possible exception of carbon monoxide poisoning in which the mixture is used in order to attempt to shift the pH of the blood to a more acid range, in order to increase the dissociation of carboxy-hemoglobin. The only other use of the mixture here has been to attempt to increase the depth of breathing transiently in

patients who are breathing voluntarily and in whom it is desired to expand the alveoli or encourage coughing, as in postoperative patients. In all anoxic or asphyxiated patients, particularly those who are not breathing voluntarily, oxygen is administered and there would seem to be no advantage to adding carbon dioxide. In patients with advanced emphysema it has, of course, been recently observed that prolonged breathing of pure oxygen may depress respiration. In such cases periods of breathing of room air are employed. I do not believe that the oxygen-carbon dioxide mixtures would be used in such patients as the concentration of carbon dioxide in the blood and alveoli is already higher than normal.\*

Wallace O. Fenn, Professor of Physiology, the University of Rochester, Strong Memorial Hospital, School of Medicine and Dentistry: \*\* \* \* in cases of asphyxia the carbon dioxide tension is already high and additional carbon dioxide would be expected to narcotize rather than to stimulate the respiratory center. Possibly for this reason the use of carbon dioxide in oxygen mixtures has been generally given up. Perhaps it should be recommended for resuscitation after carbon monoxide poisoning because it helps to eliminate carbon monoxide from the blood. I believe that Schermer, Ivy, and others have also found no benefit from the use of carbon dioxide in practical tests of resuscitation.\*

David G. Greene, The University of Buffalo, School of Medicine, Buffalo General Hospital, Department of Medicine: \* \* \* with the possible exception of carbon monoxide poisoning, there is no rationale for adding carbon dioxide to oxygen in the gas used for resuscitation. The anesthetists here concur in this opinion.\*

André Courmand, Cardio-Pulmonary Laboratory, Bellevue Hospital, Chest Service, (Columbia University Division): \* \* \* I see no indication for the use of oxygen-carbon dioxide mixtures in resuscitation with or without resuscitators. In my experience, high oxygen-nitrogen mixtures can be used with satisfaction for prolonged periods of time.\*

W. K. Nowill, Assistant Professor of Anesthesiology, Department of Surgery, School of Medicine, Duke University: \* \* \* general opinion is that 100 percent oxygen is proper for resuscitation in acute cases. For prolonged resuscitation, 50 to 70 percent oxygen with nitrogen or helium is thought to be better. Five percent carbon dioxide is used only in cases of carbon monoxide poisoning. However, the problems involved in resuscitation are far from being solved. The effect of carbon dioxide on body physiology during various types of asphyxial states are incompletely known.\*

Albert Faulconer, Section on Anesthesiology, Mayo Clinic: " \* \* \* Common practice at the Mayo Clinic in resuscitation from cardio-respiratory failure includes the use of 100 percent oxygen. Oxygen with carbon dioxide added is not used for this purpose."

Joseph H. Holmes, Professor of Medicine, University of Colorado, Department of Medicine: "The group here do not use the carbon dioxide mixture but use 100 percent oxygen."

Jay Jacoby, Director of Anesthesia, University Hospital, The Ohio State University: "Oxygen is the preferred gas for resuscitation. Patients who require resuscitation already have built up an abnormally high blood carbon dioxide level, and it is not logical to administer more. Carbon monoxide poisoning is almost the only exception, since there is no increase of carbon dioxide in the blood, and a slight increase would be of some value, not as a respiratory stimulant, but in hastening the breakdown of carbon monoxide-hemoglobin combination."

### DISCUSSION

The argument that in resuscitation the addition of carbon dioxide to oxygen will stimulate respiration was plausible. Unfortunately the issue was never resolved by adequate experiments until 1948(9, 10). In the one situation where carbogen would seem effective, carbon monoxide poisoning, no advantage was found in using the mixture for mechanical artificial respiration. In other situations the body may be flooded with an excess of carbon dioxide; the addition of more would not be useful and might be harmful. In nerve gas poisoning, for example, the diaphragm may be paralyzed; respiration stops and life depends on artificial respiration, continued until normal respiratory activity is re-established. Resuscitation can be accomplished with air alone, especially if atropine is used. Atropine's actions on the central and peripheral nervous systems and on effectors shorten the time required to restore breathing and diminish respiratory embarrassment by such factors as bronchial secretion. Oxygen is desirable, but mixing 7 percent carbon dioxide with it dams back the excess of carbon dioxide accumulated in the body.

### CONCLUSIONS

In resuscitation from carbon monoxide poisoning the use of carbogen is of questionable value. In resuscitation from other forms of asphyxia its use may be harmful. Expert respiratory physiologists and anesthesiologists generally prefer 100 percent oxygen to carbogen in artificial respiration although some think the latter may be useful in treating asphyxia caused by carbon monoxide. Because the use of carbogen may be harmful in some types of asphyxia, there is danger in having both 100 percent

oxygen and carbogen available. Logistic considerations also argue against the use of both. It is recommended that the admixture of carbon dioxide with oxygen for artificial respiration be abandoned.

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*Dictionary of Civil Defence*, Edited by Carlton Wallace, Associate Fellow Institute of Civil Defence. 160 pages; illustrated. Philosophical Library, New York, N. Y., publishers, 1952. Price \$2.75.

*Malignant Disease and its Treatment by Radium, Volume IV*, by Sir Stanford Cade, K. B. E., C. B., F. R. C. S., M. R. C. P., F. F. R. (Rho), Surgeon, Westminster Hospital, Consulting Surgeon, Mount Vernon Hospital and Radium Institute, Lecturer in Surgery, Westminster Medical School and formerly Examiner in Surgery, University of London, Member of the Council, late Hunterian Professor, Aris and Gale Lecturer and member of the Court of Examiners, Royal College of Surgeons of England; Hoo. Member American Radium Society; Consultant in Surgery to the Royal Air Force. With a foreword by Sir Ernest Rock Cawing. F. R. C. P., F. R. C. S., F. F. R., Consulting Surgeon and Vice-President, Westminster Hospital. 2d edition. 344 pages; illustrated. The Williams & Wilkins Co., Baltimore, Md., publishers, 1952.

*Operative Neurosurgery, With Emphasis on Procedures in Trauma*, by Elissa Stephens Gurdjian, M. D., Professor of Neurosurgery, Wayne University College of Medicine; Chief, University Neurosurgical Service, Grace Hospital, Detroit, Mich., and John E. Webster, M. D., Assistant Professor of Surgery, Wayne University College of Medicine; University Neurosurgical Service, Grace Hospital, Detroit, Mich. 422 pages; illustrated. The Williams & Wilkins Co., Baltimore, Md., publishers, 1952. Price \$10.

*Physics and Medicine of the Upper Atmosphere, A Study of the Aeropause*, Edited by Clayton S. White, M. D., Director of Research, Lovelace Foundation for Medical Education and Research. Head of a Section of Aviation Medicine, Lovelace Clinic, and Otis O. Benson, Jr., Brigadier General, USAF (MC), Commandant, USAF School of Aviation Medicine. The Proceedings of a Symposium on the Physics and Medicine of the Upper Atmosphere held at San Antonio, Tex., November 6, 7, 8, 9, 1951, sponsored by The Air University School of Aviation Medicine, Randolph Field, Tex. Arranged by The Lovelace Foundation for Medical Education and Research, Albuquerque, N. M. 611 pages, illustrated. Published by the University of New Mexico Press, Albuquerque, 1952. Price \$10.

*Electrotherapy and Actinotherapy, A Textbook for Student Physiotherapists*, by E. B. Clayton, M. B., B. Ch. (Cantab.), Consulting Physician to The Physical Treatment Department, King's College Hospital, London. 2d edition. 452 pages; illustrated. Published in the United States by The Williams & Wilkins Co., Baltimore, Md., publishers, 1952. Price \$4.

# THORACOABDOMINAL INCISION FOR RESECTION OF ADRENAL TUMORS<sup>(1)</sup>

R. MAURICE HOOD, Lieutenant, MC U. S. N.

EVERETT H. DICKINSON, Captain, MC U. S. N.

THE necessity for surgical resection of lesions of the adrenal gland is becoming quite common. This is attested to by the rather numerous reports appearing in the literature of the past 5 years (2-6). Despite the work of Chute et al. (7-9) which points out the advantages of the thoracoabdominal approach to the kidney and the adrenal gland, this approach is not yet commonly used. Sweet (10) has stated that transthoracic incisions offer the best approach to the adrenal glands, and Grimson et al. (5) have used a transdiaphragmatic approach. Priestley et al. (6), although admitting the superiority of the exposure, apparently favor a posterolateral incision. Our experience, although limited, has clearly indicated the superiority of the thoracoabdominal exposure of the adrenal area.

The adrenal glands, though lying beneath the diaphragm, are well within the thoracic cage lying opposite the ninth and tenth ribs posteriorly. The surgical approach transperitoneally is characterized by difficult exposure chiefly because of the overlying liver on the right side and spleen, stomach, and pancreas

(1) Surgical Service, U. S. Naval Hospital, Oakland, Calif.

(2) Mortensen, H., and Murphy, L.: Feminizing adrenal tumor in adult male. *J. Urol.* 65: 709-714, May 1951.

(3) Pyle, F. J.: Pheochromocytoma; report of malignant case (pheochromoblastoma). *J. Urol.* 66: 153-162, Aug. 1951.

(4) Garrett, R. A.: Adrenal cortical carcinoma in children. *J. Urol.* 66: 477-485, Oct. 1951.

(5) Grimson, K. S.; Emlet, J. R.; and Hamblen, E. C.: Diagnosis and management of tumors of adrenal gland. *Ann. Surg.* 134: 451-463, Sept. 1951.

(6) Priestley, J. T.; Spague, R. G.; Walters, W.; and Salassa, R. M.: Subtotal adrenalectomy for Cushing's syndrome; preliminary report of 29 cases. *Ann. Surg.* 134: 464-475, Sept. 1951.

(7) Chute, R., and Soutter, L.: Thoraco-abdominal nephrectomy for large kidney tumors. *J. Urol.* 61: 689-696, Apr. 1949.

(8) Chute, R.; Soutter, L.; and Kerr, W. S., Jr.: Value of thoracoabdominal incision in removal of kidney tumors. *New England J. Med.* 241: 951-960, Dec. 15, 1949.

(9) Chute, R.: Thoraco-abdominal incision in urological surgery. *J. Urol.* 65: 784-794, May 1951.

(10) Sweet, R. H.: *Thoracic Surgery*. W. B. Saunders Co., Philadelphia, Pa., 1950. p. 213.

on the left. The flank and paravertebral incisions, even with resection of the twelfth or eleventh ribs, provide a limited exposure. Definitive surgery by means of these approaches is fraught with danger because the exposure is inadequate for accurate control of the adrenal blood supply. Poor exposure is particularly dangerous in patients with pheochromocytoma in whom digital manipulation of the tumor in order to deliver it may result in a fatal paroxysm of hypertension.

Exposure of the adrenal area, by entering the pleural space through the ninth or tenth interspace and incising the diaphragm, obviates these difficulties and permits a safe, orderly resection of whatever lesion may be present. The degree of exposure is superlative and cannot be equaled by any other approach. Rib resection or fracture has been unnecessary in either case. Transthoracic or thoracoabdominal approaches for upper abdominal operations may be accomplished without increased morbidity or mortality over that of abdominal, flank, or lumbar incisions.

### CASE REPORTS

*Case 1.* A 49-year-old man was transferred to this hospital on 27 December 1951 because of hemoptysis occurring 1 week previously. He had been discharged from the military service in 1945 with a diagnosis of hypertensive vascular disease and had been under the care of a private physician who had treated him with diet, phenobarbital, and restriction of activity. Aside from the episode of hemoptysis his only symptoms were severe intermittent headaches and slight dyspnea. The headaches occurred from 1 to 3 times daily, were sudden in onset, and lasted for from a few minutes to 3 hours. The systolic blood pressure had been recorded as high as 240. The physical findings, except for the blood pressure, were within normal limits.

Because of the intermittent character of the headaches, the blood pressure was taken every 30 minutes. The resultant chart revealed that the patient maintained levels of about 130/80 most of the time and that corresponding to the onset of an attack of headache the blood pressure would rise abruptly, reaching levels as high as 275/120. Seventeen milligrams of piperazine hydrochloride given intravenously during a hypertensive seizure resulted in a precipitous drop in systolic pressure from 265 to 210 over an 11-minute period.

Serial ECG's were interpreted as showing myocardial ischemia. Roentgenograms following retroperitoneal oxygen insufflation clearly demonstrated a 4- by 4-cm. rounded shadow in the right adrenal area.

On 25 February 1952 the right adrenal area was explored through a thoracoabdominal incision. A firm tumor mass measuring 4 by 4 cm. was discovered lying in the medullary portion of the gland. The tumor was resected without difficulty. The postoperative course was uneventful. The patient's blood pressure remained at normal levels and there was no recurrence of headaches. The pathologist reported a benign pheochromocytoma.

*Case 2.* A 31-year-old woman was transferred to this hospital on 2 February 1952 with a tentative diagnosis of Cushing's syndrome. Her illness began in 1945 when she developed increasing obesity, swelling of the lower extremities, and fatigability. During the interval from the onset until 6 weeks prior to admission she developed, with intermittent regression and progression, hirsutism, deepened vocal tone, amenorrhea, abdominal striae, rounded facies, and hypertension. In August 1951 she was successfully delivered at term of a live infant following a pregnancy which was complicated by severe hypertension. Six weeks prior to admission she developed progressive signs of cardiac failure characterized by peripheral edema, dyspnea, hemoptysis, and oliguria.

Physical examination revealed the external characteristics of Cushing's syndrome, a blood pressure of 200/120, dependent edema, and evidence of pulmonary edema. Urinalysis showed persistent albuminuria (200 mg. per 100 cc.). The serum cholesterol was 556 mg. per 100 cc. The glucose tolerance was impaired. Urinary 17-ketosteroids ranged from 15.2 to 64.5 mg. per 24 hr. Following an intravenous injection of phenolsulfonphthalein there was 5 percent excretion in 15 min. The ECG showed left axis deviation. Roentgenograms of the chest revealed moderate cardiac enlargement, predominately left ventricular. A gallbladder series showed a functioning gallbladder with cholelithiasis. Roentgenograms following retroperitoneal oxygen insufflation revealed a 45-by 60-mm. oval tumor mass lying in the area of the right adrenal gland.

The patient was treated by digitalization, diuretics, salt-poor diet, and bed rest with some improvement and weight loss. After giving 100 mg. of cortisone daily for 3 days preoperatively, she was taken to surgery on 21 March. A thoracoabdominal incision was made. As soon as the diaphragm was opened the tumor was visualized and resection was accomplished without incident. The left adrenal gland was palpated and believed to be normal. The postoperative course was uneventful. The dosage of cortisone was gradually decreased and after 10 days discontinued. ACTH was administered in diminishing doses starting

with 25 mg., and discontinued after 10 days. The patient subsequently manifested no symptoms of adrenal insufficiency. The pathologist reported a benign adrenocortical adenoma.

*Case 3.* A 45-year-old man was admitted to the hospital on 16 April 1952 complaining of headache, nausea, and vomiting. He stated that the headaches first began in 1949. The onset of each headache was rapid, occurring usually in the midmorning and lasting for from 30 minutes to 2 hours, then slowly subsiding. His pain was bilateral and was located in the frontal and temporal areas. Frequently nausea would accompany the attack. He had been admitted previously for the same complaints. During the investigation at that time he had a histamine gastric analysis. The injection of histamine precipitated a severe attack of headache associated with syncope. He was discharged with a neuropsychiatric diagnosis.

Examination, except for the blood pressure, was within normal limits. The blood pressure taken during one of the attacks was recorded as high as 230/196. In the interim between attacks his blood pressure was recorded at about 130/90. Eighteen milligrams of piperazine hydrochloride, given during a paroxysm of hypertension, resulted in a precipitous drop in his blood pressure from 230/196 to 165/118 within 20 minutes. Roentgenograms following retroperitoneal oxygen insufflation revealed that there was a 6- by 6-cm. rounded tumor mass lying in his right adrenal area.

On 9 May he was taken to surgery. A transthoracic approach was made. The tumor was easily palpable as soon as the diaphragm was opened and resection was accomplished without incident. As soon as the tumor was removed his blood pressure dropped to unobtainable levels despite the rapid administration of norepinephrine. At this time he developed ventricular tachycardia and within 1 minute cardiac arrest occurred. The pericardium was opened and his heart was found to be in standstill. Massage was begun and 0.5 cc. of 1:1000 epinephrine was injected into his heart. Massage was continued and another injection of epinephrine was given 5 minutes later. At this time his heart began to beat regularly at a rate of 40 to 50 beats per minute. An ECG revealed that a ventricular rhythm was present. His blood pressure was recorded during this time at about 70/40. After 1½ hours, P waves began to appear in the ECG and a normal sinus rhythm was soon re-established. It was necessary to give norepinephrine intravenously to maintain his blood pressure in the next 24 hours, but after that his recovery was uneventful. His blood pressure remained at normal levels and there was no recurrence of headaches. There was no evidence of damage to the central nervous system from the period of cardiac arrest.

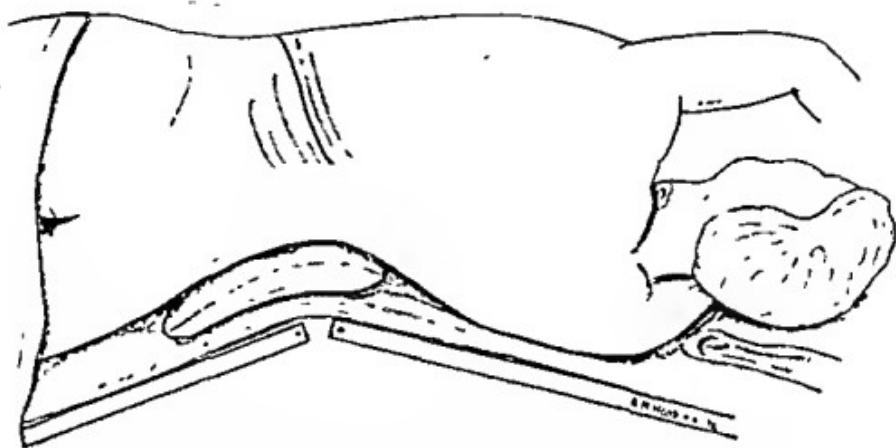


Figure 1. A drawing showing the position of the patient on the operating table and the approximate location of the incision.

### OPERATIVE TECHNIC

Anesthesia is induced with an intravenous injection of pentothal sodium and an endotracheal tube introduced. Anesthesia is then changed to ether-oxygen for the remainder of the procedure. The patient is placed in the position shown in figure 1. A skin incision from 10 to 12 inches long is made over the ninth or tenth interspace, beginning about 1 inch from the spinous processes and extending to the end of the interspace and as far

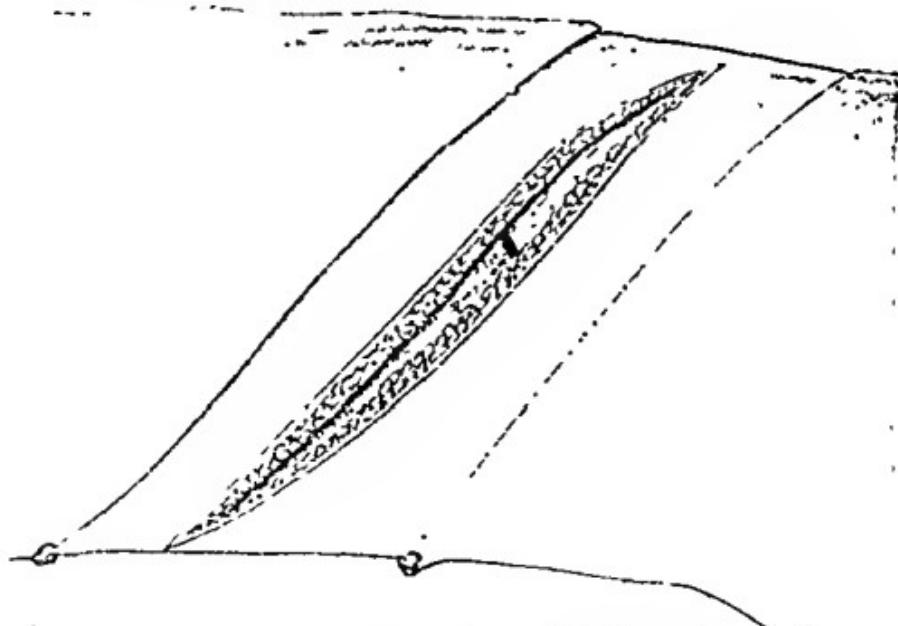


Figure 2. A drawing showing the completed skin incision.

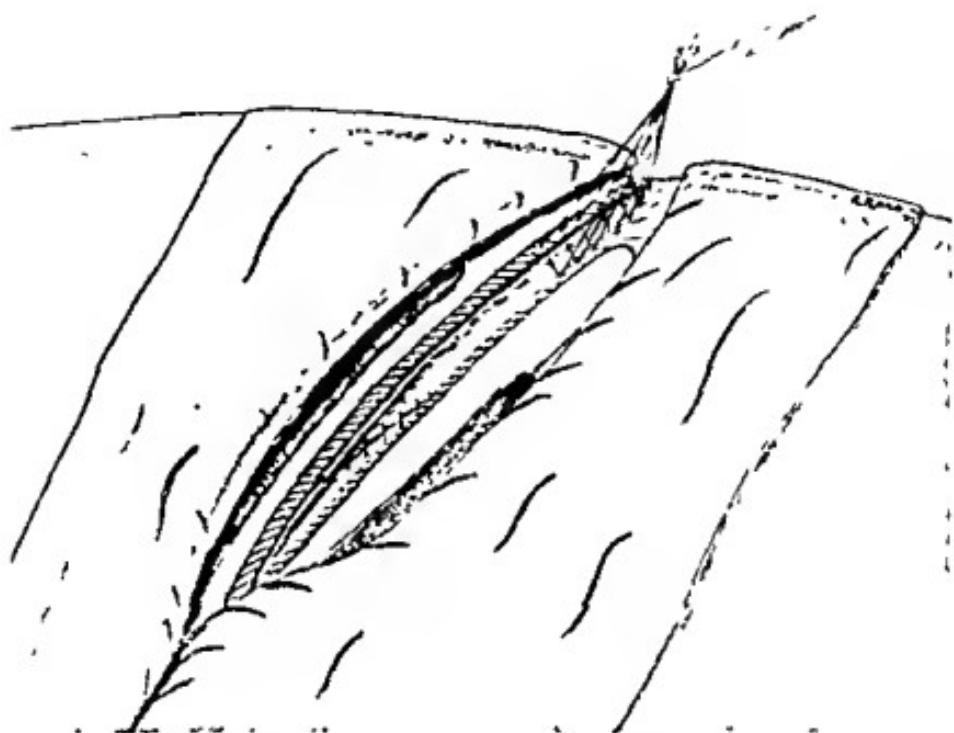


Figure 5. A drawing showing the wound after repair of the diaphragm and closure of the intercostal space by interrupted sutures.

not be differentiated, but discrepancy in the size of the glands may be apparent. Therefore, we believe that bilateral exposure is unnecessary in most patients and certainly not at the same time.

The retroperitoneal, oxygen-insufflation technic via the retrorectal space represents an important forward step in the ability to demonstrate tumors in the renoadreial area. It can be accomplished safely and painlessly by the unexperienced operator with consistently good results. This technic should not be confused with the older technic of perirenal insufflation which was associated with a high mortality rate. In most cases the patient experienced excruciating pain and the resulting roentgenographic studies were inconsistent or useless.

# EXPERIMENTAL LOCATION OF MYOCARDIAL INFARCTION USING RADIOISOTOPES<sup>(1)</sup>

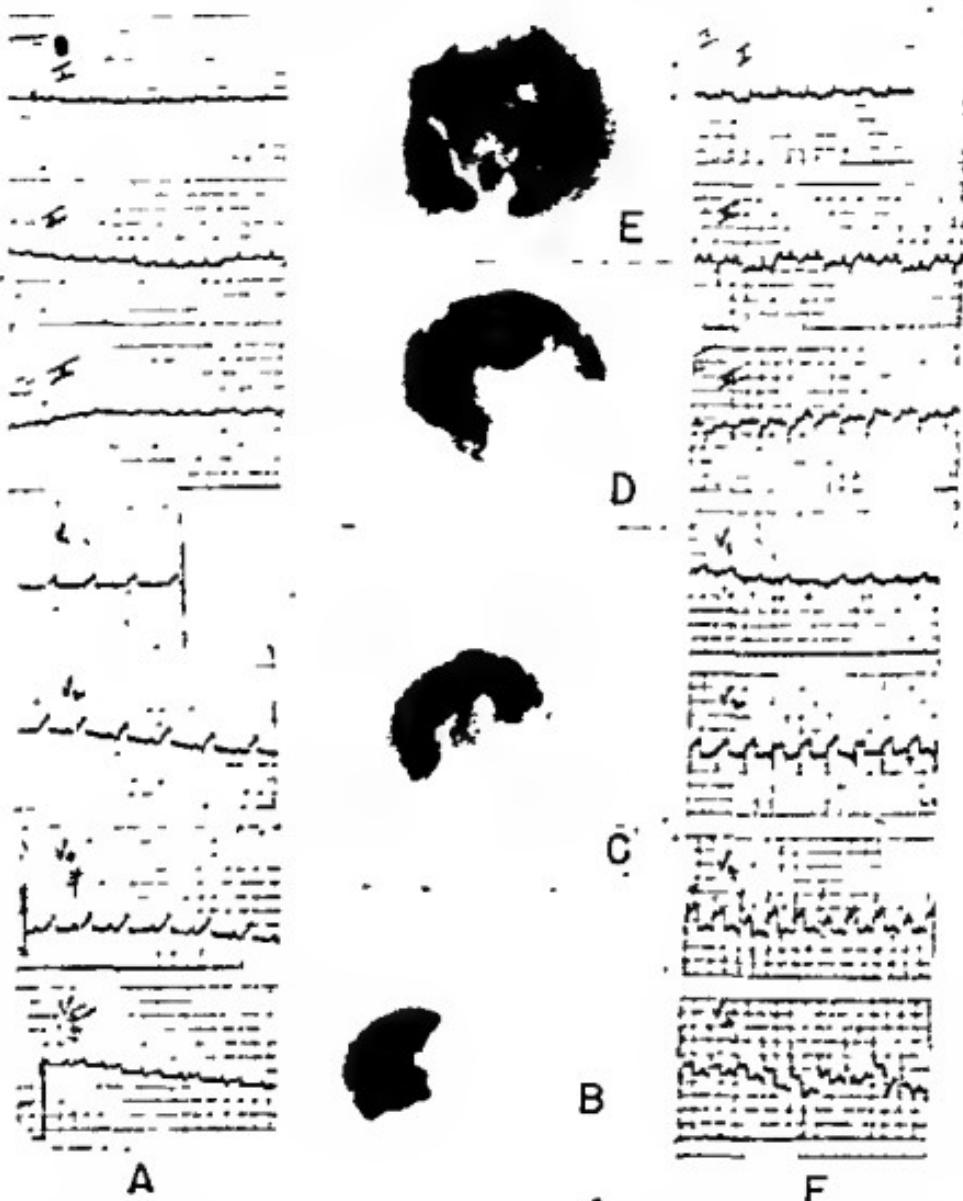
WALTER K. YATES, *Captain, U. S. A. F. (MC)*

**A**CCURATE determination of the location and size of a myocardial infarction has long been a problem at postmortem examination. Infarctions are often difficult to find by either gross or microscopic methods. This situation constitutes a dilemma for the pathologist, the clinician, and the student of electrocardiography. This report describes a simple method, based on the absence of a radioactive isotope in the infarcted area whereby an accurate determination of the size and position of the infarction may be made at autopsy.

## PROCEDURE

The method was developed and demonstrated on 13 dogs in which experimental infarctions were induced by the following procedure. The extremities were shaved to allow proper contact of electrocardiographic electrodes. The anterior surface of the chest was shaved and surgically prepared. The animal was anesthetized with an intravenous injection of pentobarbital sodium and an oxygen cannula was inserted into the trachea. Cannulas were inserted into the femoral artery for direct blood pressure determinations and into the femoral vein for fluid administration. ECG's were recorded, using the standard limb leads, the unipolar limb leads, and leads V<sub>1</sub>, V<sub>2</sub>, V<sub>4</sub>, and V<sub>5</sub>. The chest was then opened at the left sternal border and the pericardium was separated. The desired coronary artery was identified and ligated. Prior to its ligation, procaine amide hydrochloride was administered intravenously to prevent ventricular fibrillation. Following ligation of the coronary artery, frequent ECG's were taken to detect the presence of developing myocardial infarction. Following appearance of a tracing typical of infarction, a radioisotope was injected intravenously. In this series radiophosphorus (P-32) was used. The amount of P-32 varied, but was usually of the order of 0.5 millicurie. At an arbitrary interval after injection of P-32, the animal was sacrificed and the heart removed for autoradiography.

(1) Experimental study conducted by the author while attending the Atomic Warfare Program at The Oak Ridge Institute of Nuclear Studies.



*Figure 1. Experiment 5. Autoradiogram taken with anterior surface of cardiac slices downward. (A) Control ECG. (B) Apex. (C) and (D) Intermediate. (E) Base. (F) ECG after occlusion.*

The technic of autoradiography has been discussed at length (2-4) and will not be reviewed here except to note the application of the technic to this experiment.

(2) Boyd, G. A.: The Physical Principles and Techniques of Autoradiographs. MDDC-1226. U. S. A. E. C., Oak Ridge, Tenn.

(3) Axelrod, D. J.: The Radioautographic Technique. Circulist Art. Isotopes Division, U. S. A. E. C., Oak Ridge, Tenn.

(4) Evans, T. C.: Radiosutographs in which tissue is mounted directly on photographic plate. Proc. Soc. Exper. Biol. & Med. 64: 313-315, Mar. 1947.

The heart was cut into serial transverse sections from base to apex. These sections were frozen, placed on roentgenographic film, and stored in a freezing unit during exposure. The circulation of the blood through nonoccluded arteries deposited the isotope uniformly in the normal myocardium. Because of the decreased circulation of the infarcted area, it was not supplied with

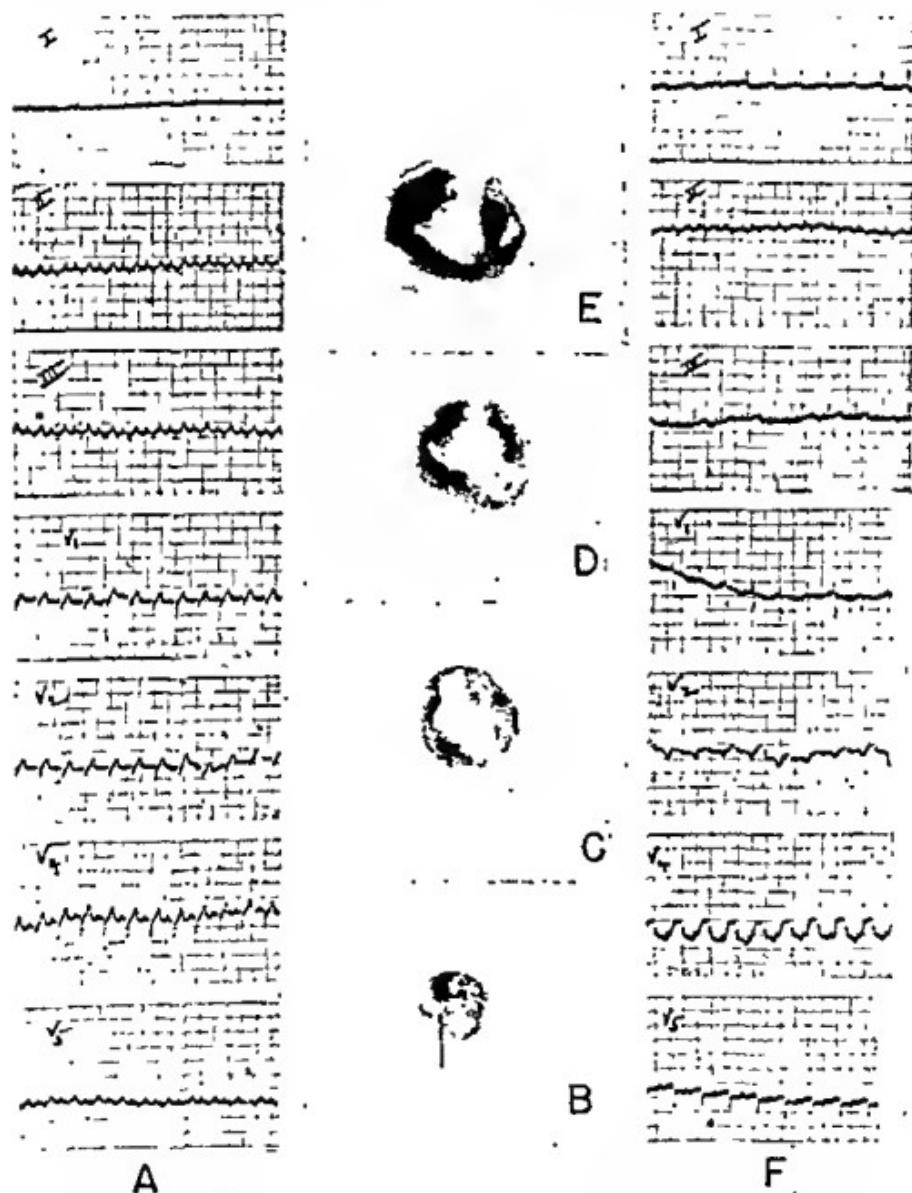
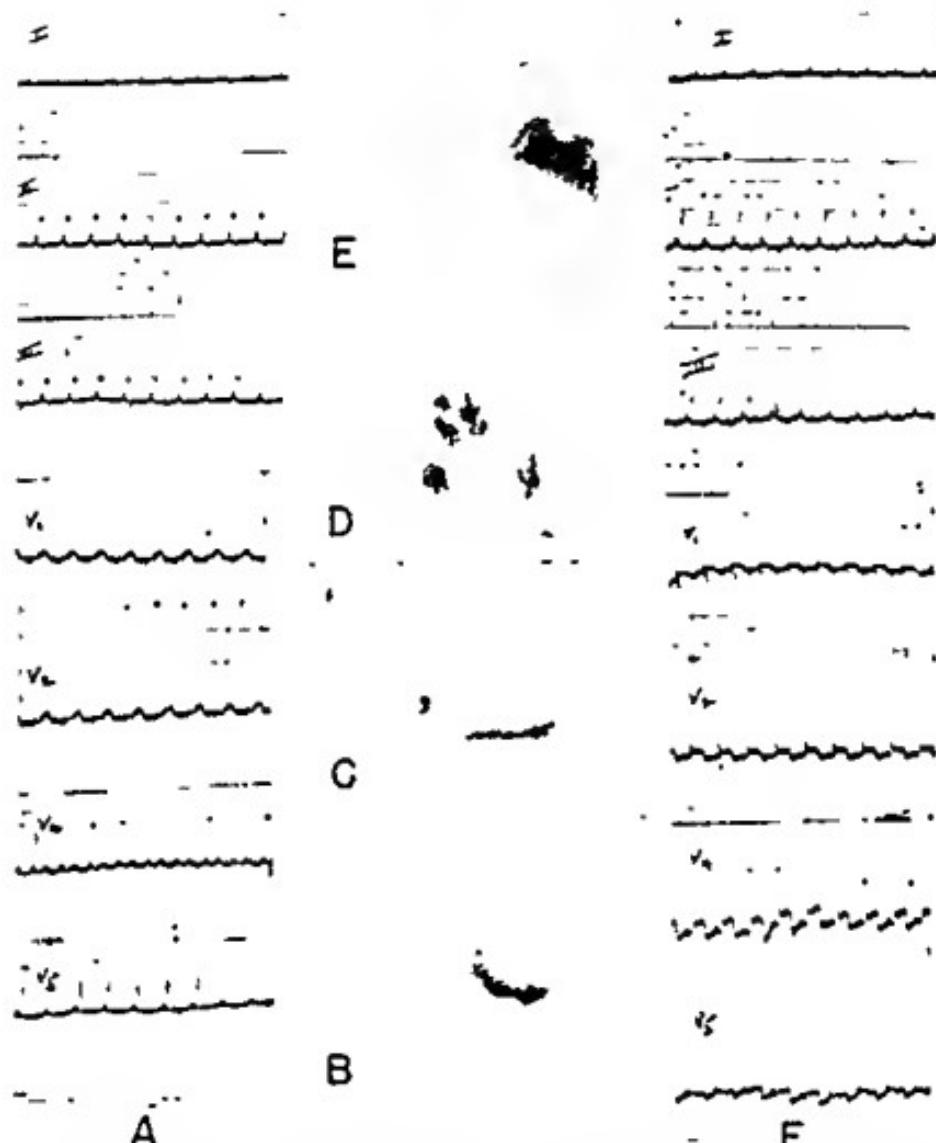


Figure 2. Experiment 7. Autoradiogram taken with anterior surface of cardiac slices downward. (A) Control ECG. (B) Apex. (C) and (D) Intermediate. (E) Base. (F) ECG after occlusion.

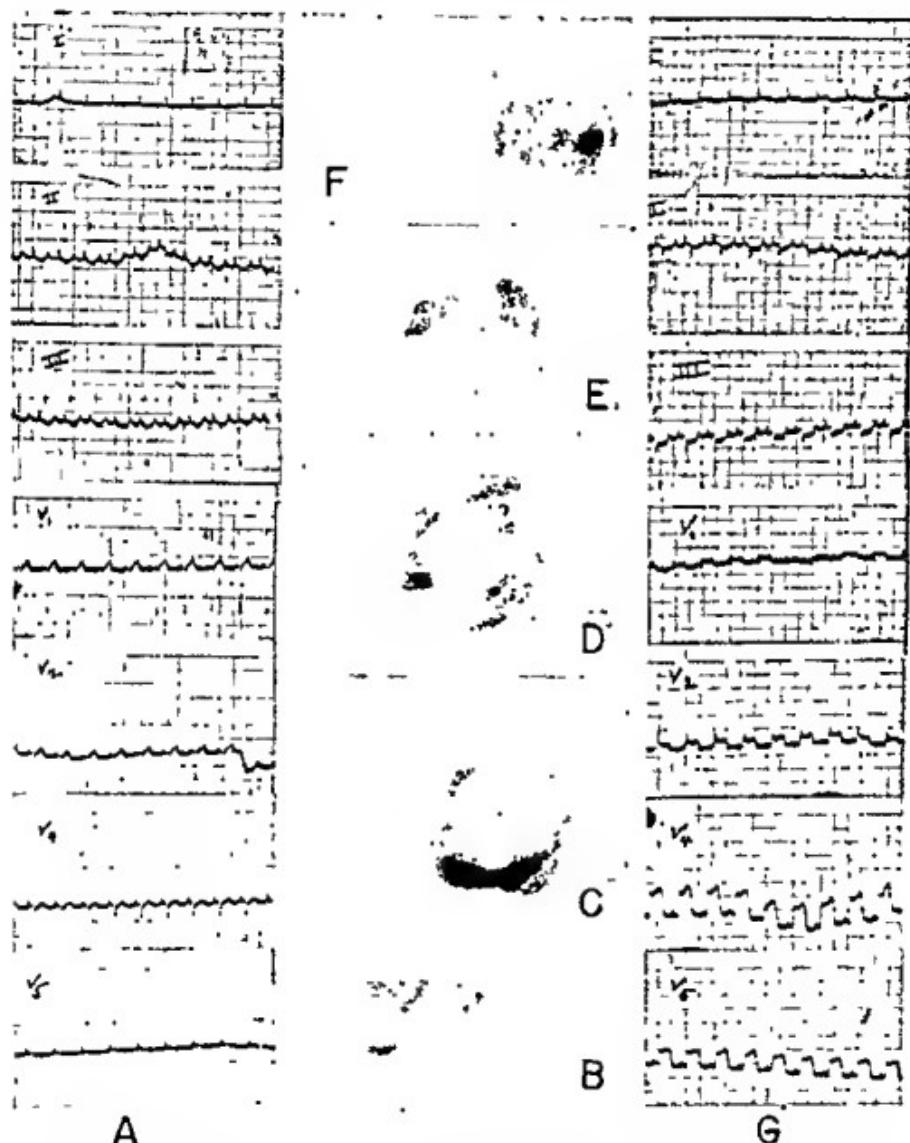


*Figure 3. Experiment 9. Autoradiogram taken with anterior surface of cardiac slices downward. (A) Control ECG. (B) Base. (C) and (D) Intermediate. (E) Apex. (F) ECG after occlusion.*

isotope and hence was not radioactive. Radioactive tissue placed in apposition to photographic film causes a latent image in the emulsion which can be seen after the film is developed. Inert tissue causes no latent image. On the photographic negative of these tissue sections, normal myocardium appears black and the infarcted areas are transparent. Proper cutting and arranging of these serial sections produces a three-dimensional conception of the exact size and position of the infarction. Representative examples of this technic are presented, including the control ECG, autoradiogram, and ECG after occlusion.

## RESULTS

*Experiment 5.* The left coronary artery was ligated near its source, causing an anterolateral myocardial infarction. The control ECG and a tracing taken 35 minutes after occlusion are shown in figure 1. One millicurie of P-32 was injected intravenously following this tracing and 45 minutes later the animal was sacrificed. The autoradiogram portrays transverse sections of the



*Figure 4. Experiment 10. Autoradiogram taken with anterior surface of cardiac slices downward. (A) Control ECG. (B) Base. (C), (D), and (E) Intermediate. (F) Apex. (G) ECG after occlusion.*

heart. The ECG shows an anterolateral infarction. This is corroborated by the radiographic "hole" in the anterolateral surface of the left ventricle.

*Experiment 7.* The chest was opened and the right coronary artery was ligated on the posterior surface of the heart. The ECG shows the control and a tracing taken 90 minutes after occlusion (fig. 2). Five-tenths millicurie of P-32 was used in this experiment. As indicated by the definite radiographic "hole" in that area, the infarction is posterior in position.

*Experiment 9.* In this case an anterior occlusion was produced near the base of the heart and 0.5 millicurie of P-32 was used. The control ECG and a tracing taken 30 minutes after occlusion are shown in figure 3. An anteroseptal infarction is evident in both the autoradiogram and in the ECG.

*Experiment 10.* In this experiment an anterior occlusion was accomplished. Four-tenths millicurie of P-32 was injected 50 minutes after occlusion and the animal was sacrificed 2 hours and 20 minutes after occlusion. The control ECG and that taken 40 minutes after occlusion are shown in figure 4. The autoradiogram and the ECG reveal anterior infarction.

## DISCUSSION

An objective procedure is more accurate than conventional techniques for the postmortem location and visualization of myocardial infarction. The method described is of interest primarily to students of electrocardiography and is most applicable to experimental animals. It might be modified in such a manner as to have clinical applications. For example, electronic radiation detection may develop to the point where an external Geiger counter would be capable of detecting radiologic "holes" *in vivo*. In such an event, this technic would be of great value in clinical diagnosis. It is also possible that this method could be adapted for use in patients in extremis who have obscure electrocardiographic findings. This would add to the information obtained at postmortem examination.

# LIVER BIOPSY IN MALARIA<sup>(1)</sup>

ROBERT C. HUNTER, Jr., Lieutenant Colonel, MC, U. S. A.

JOHN A. SHEEDY, Major, MC, U. S. A.

THE presence of jaundice in patients with malaria has been noted frequently (2-6) although the incidence varied widely (table 1). Stratman-Thomas (7) stated that this jaundice was caused by rapid destruction of red blood cells which also produced a marked anemia. Radvan and Apreutesci (8) pointed out that hemolysis did not always account for the jaundice because icterus was present in some patients without detectable anemia. Other authors have indicated that hepatocellular damage (manifested by hepatomegaly (3, 6, 9); elevated cephalin-cholesterol flocculation (6, 9-15); decreased serum albumin

(1) Letterman Army Hospital, San Francisco, Calif.

(2) Hill, A. G.: Malarial jaundice. Am. J. M. Sc. 212: 45-53, July 1946.

(3) Kern, R. A., and Norris, R. F.: Liver involvement in malaria. U. S. Nav. M. Bull. 43: 847-858, Nov. 1944.

(4) Bunker, H. A., Jr., and Kirby, G. H.: Treatment of general paroxysms by inoculation with malaria. J. A. M. A. 84: 563-568, Feb. 21, 1925.

(5) Chalmers, T. C., Jr.: Occurrence of jaundice in therapeutic and natural malaria. J. Clin. Investigation 26: 1055-1059, Nov. 1947.

(6) Read, H. S.; Kaplan, L. I.; Becker, F. T., and Boyd, M. F.: Analysis of complications encountered during therapeutic malaria. Ann. Int. Med. 24: 444-464, Mar. 1946.

(7) Stratman-Thomas, W. K.: Infection in intermediate host symptomatology; vivax malaria. In American Association for the Advancement of Science (M. F. Boyd, Chairman, Publication Committee): A Symposium on Human Malaria With Special Reference to North America and the Caribbean Region. Publication No. 15. American Association for the Advancement of Science, Washington, D. C., 1941. pp. 183-189.

(8) Radvan, L., and Apreutesci, C.: La bilirubinémie paludéenne par rapport à la physiopathologie et à la thérapeutique. Riv. di malariol. 26: 183-190, Aug. 1947.

(9) Fredricks, M. G., and Hollsbauer, F. W.: Study of hepatic function in therapeutic malaria. J. A. M. A. 128: 495-499, June 16, 1945.

(10) Lippincott, S. W.; Ellerbrook, L. D.; Hesselbrock, W. B.; Gordon, H. H.; Gottlieb, L.; and Marble, A.: Liver function tests in chronic relapsing vivax malaria. J. Clin. Investigation 24: 616-622, Sept. 1945.

(11) Schneider, J. (Paris), and Hartman, L.: Explorations fonctionnelles hépatiques au cours du paludisme. Étude systématique au cours du paludisme d'inoculation. Bull. Soc. path. exot. 42: 259-267, Jan. 1949.

(12) Makari, J. G.: Cephalin flocculation test in malaria. Brit. M. J. 1: 272-273, Feb. 23, 1946.

(13) Guittman, S. A.; Potter, H. R.; Hangar, F. M.; Moore, D. B.; Pierson, P. S.; and Moore, D. H.: Significance of cephalin-cholesterol flocculation test in malarial fever. J. Clin. Investigation 24: 296-300, May 1945.

(14) Kopp, L., and Solomon, H. C.: Liver function in therapeutic malaria. Am. J. M. Sc. 205: 90-97, Jan. 1943.

(15) Mursky, I. A.; von Brecht, R.; and Williams, L. D.: Hepatic dysfunction in malaria. Science 99: 20-21, Jan. 7, 1944.

(11, 13, 16); reduced serum cholesterol and cholesterol esters (11, 13, 14); and increased bromsulphalein retention, particularly in the jaundiced patients (2, 3, 5, 9, 13, 14)) was a factor in producing this jaundice.

TABLE I. Incidence of jaundice in malaria

Authors	Type of malaria	Number of patients	Percent with jaundice
Hills (2)	Natural	8,837	0.27
Kem and Norris (3)	Natural	54	61.0
Bunker and Kirby (4)	Therapeutic	53	34.0
Chalmers (5)	Therapeutic	450	8.0*
Read et al. (6)	Therapeutic	300	7.3

\*Some of these patients were thought to have impaired hepatic function before they were given malaria.

Manson-Bahr (17) described extensive damage in the livers of patients dying of malaria, the degree of damage varying with the intensity of the infection. The livers were enlarged and pigmented. The parenchymal cells showed all stages of destruction, with cloudy swelling and, in severe cases, widespread central necrosis. These cells contained hemosiderin and gave the Prussian blue reaction. The sinusoids were congested and contained malarial parasites. The Kupffer cells contained the malarial pigment, hemezoin, which did not give the Prussian blue reaction unless pretreated with nitric acid and hydrogen peroxide.

These pathologic changes were found in patients dying of severe malaria and in whom fever, toxicity, and anemia may have combined to produce liver damage of a nonspecific nature. There has been a paucity of information on the histology of the liver in nonfatal cases of malaria. Fredericks and Hoffbauer (9) reported a biopsy of a normal-appearing liver in a patient with malaria. Milanes et al. (18) also reported a patient with malaria in whom liver biopsy showed degeneration of the polygonal cells, periportal round-cell infiltration, and pigment in the Kupffer cells, but, as the authors stated, concomitant viral hepatitis could not be ruled out.

(10) Kopp, L., and Solomon, H. C. Relationship of hypoalbuminemia to edema of malaria. Am. J. M. Sc. 202: 861-868, Dec. 1941.

(17) Manson-Bahr, P. H. *Manson's Tropical Diseases*. 12th edition. Williams & Wilkins Co., Baltimore, Md., 1945.

(18) Milanes, F., Leon Blanco, P., Llanio, R., and Causa, A. Sobre un caso de paludismo con icterus hepatocelular & Secundario o concomitante? Consideraciones patogénicas. Vida nueva 63: 41-49, Feb. 1949.

In experimental malaria in animals, Andrews (19) demonstrated centrilobular degeneration and necrosis as well as fatty infiltration in the liver. The sinusoids were congested with parasitized erythrocytes and the Kupffer cells were swollen with red blood cells, pigment, parasites, and debris. He attributed the parenchymal-cell damage to anoxia.

The present study was undertaken in an effort to elucidate the nature of jaundice occurring in malarial patients, with particular reference to the histologic changes in the liver as shown by needle biopsy specimens. It is based on 8 selected patients with malaria, caused by *Plasmodium vivax* in 7 and type undetermined in 1. The clinical findings were similar to those of viral hepatitis in all 8 patients. Twenty unselected patients with viral hepatitis seen during the same period served as controls.

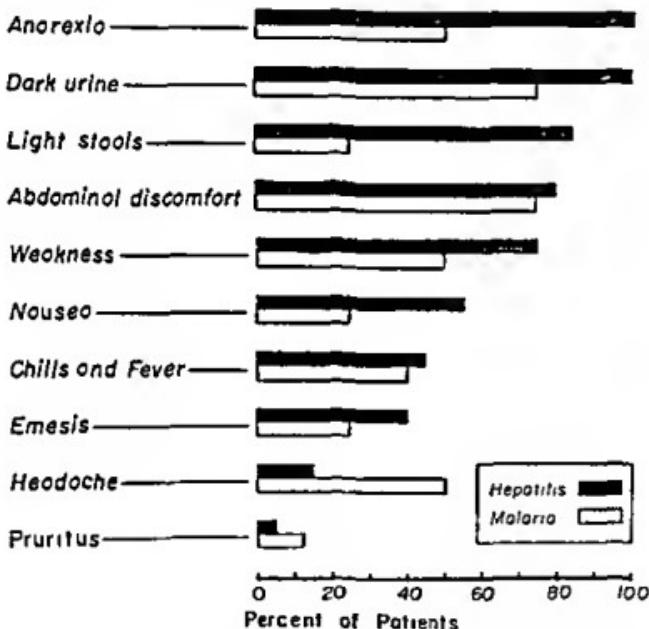


Figure 1. Symptoms in patients with hepatitis and malaria.

## RESULTS

The symptoms (fig. 1) and physical findings (fig. 2) in the group of 8 patients with malaria were similar to those in the group of 20 with viral hepatitis. The initial laboratory findings (table 2) also showed more similarities than differences. Additional miscellaneous comparisons (table 3) showed that the

(19) Andrews, W. H. II: Liver lesions in malaria. Tr. Roy. Soc. Trop. Med. & Hyg. 41: 699-702, May 1948.

duration of the illness was distinctly less in the patients with malaria. One-half of the patients with hepatitis were diagnosed serum hepatitis, the other half, infectious hepatitis. There was no history of excessive use of alcohol or exposure to hepatotoxic agents in either group. All of the patients recovered.

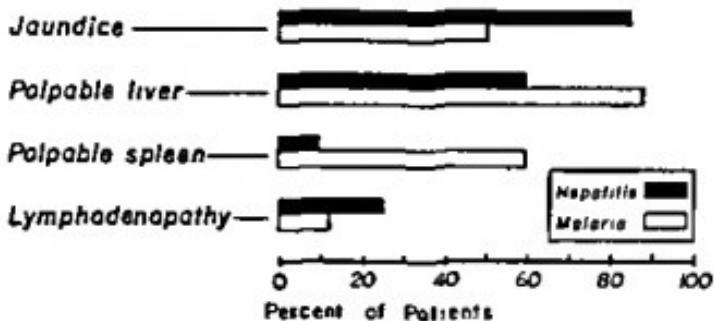


Figure 2. Physical findings in patients with hepatitis and malaria.

### CASE REPORTS

*Case 1.* A 22-year-old man was wounded in Korea on 1 March 1951 and underwent an amputation of the right leg 1 week later. He received blood and plasma during this period. On 4 and 6 May he had chills and fever and a blood smear revealed *P. vivax*. He was treated with chloroquine. On 20 July he was given a blood transfusion during another operation on his leg. His hemo-

TABLE 2. Average initial laboratory findings in patients with hepatitis and malaria.

	Hepatitis	Malaria
Hemoglobin (grams per 100 cc.)	14.2	12.6*
Serum bilirubin (mg. per 100 cc.)	7.8	3.0
Serum albumin (grams per 100 cc.)	4.4	3.6
Serum globulin (grams per 100 cc.)	3.3	3.5
Serum cholesterol (mg. per 100 cc.)	226.0	140.6
Serum cholesterol esters (percent of cholesterol)	52.2	62.2
Urine urobilinogen (Ehrlich units per 2 hours)	2.1	2.4
Zinc sulfate turbidity	18.0	16.2
Thymol turbidity	13.7	12.7
Cephalin-cholesterol flocculation**	11	7

\*Includes 2 patients with severe hemolysis and hemoglobin of 6.1 and 10.7 gm. respectively.

\*\*This figure is not an average but the actual number of patients with readings greater than 2 plus.

globin was 13.3 following the operation. On 18 August he lost his appetite and several days later his urine became dark and his skin jaundiced. His serum bilirubin was 4.5 mg. per 100 cc.; thymol turbidity, 12; cephalin-cholesterol flocculation, 3 plus; blood cholesterol and proteins, normal. During the next 3 weeks his jaundice gradually deepened and on 14 September he was transferred to the medical service with a serum bilirubin of 14.9 mg. per 100 cc. On 17 and 19 September he again had chills and fever and a blood smear again revealed *P. vivax*. He was treated with chloroquine and had no further recurrences of malaria. By November he had completely recovered from the hepatitis.

TABLE 3. *Miscellaneous comparative findings in patients with hepatitis and malaria*

	Hepatitis	Malaria
Average age (years)	24.9	24.4
Number of patients who had had a transfusion or venipuncture within 6 months	10	2
Number of patients who had had a gradual onset	13	6
Number of patients who had had an acute onset	7	6
Delay prior to hospitalization (days)	8.7	5.5
Duration of clinically evident hepatocellular disease (weeks)	9.2	4.3

A liver biopsy specimen taken 2 days after his last chill showed the parenchymal cells arranged in an irregular pattern, granular cytoplasm, and a small amount of pigment in some cells. Occasional nuclei were hyperchromatic with an increased nuclear-cytoplasmic ratio and other nuclei were multiple. In places, the small bile ducts contained inspissated bile. There were a few round cells and occasional polymorphonucleocytes in the portal areas. The pathologic diagnosis was hepatitis.

*Case 2.* A 23-year-old man noted the gradual onset of anorexia on the day after his return to the United States from Korea. This was followed during the next 2 weeks by nausea, vomiting, fever, dark urine, light stools, and jaundice. The only significant physical finding was jaundice. His hemoglobin was 17.8; serum bilirubin, 9.4 mg. per 100 cc.; thymol turbidity, 16; cephalin-cholesterol flocculation, 4 plus; serum albumin, 3.5 grams per 100 cc.; and serum globulin, 3.8 grams per 100 cc. On the twentieth hospital day he had a chill, a temperature of 103° F., and headache. Blood smear revealed *P. vivax*. His malaria responded

On the evening of admission and again the next morning, he had a chill with a temperature rise to 103.6° F. He was treated with chloroquine and had a rapid and complete recovery. A liver biopsy specimen taken 6 days after his last chill revealed a normal liver.

*Case 6.* A 20-year-old man had an episode of headache, chills, and fever on board ship when returning from Korea. Six days later he had a recurrence, but on this occasion he also had dark urine. He was admitted to the sick bay. Blood smears failed to reveal malarial parasites. On arrival at this hospital 1 week later, he appeared acutely ill, was slightly jaundiced, had a palpable liver and spleon, and no fever. A blood smear was positive for *P. vivax*. His hemoglobin was 12.7; serum bilirubin, 1.3 mg. per 100 cc.; thymol turbidity, 16; cephalin-cholesterol flocculation, 4 plus; serum cholesterol, 49 mg. per 100 cc.; cholesterol esters, 5 mg. per 100 cc.; serum albumin, 3 grams per 100 cc.; and serum globulin, 3.5 grams per 100 cc. Three days after admission he had a chill and his temperature rose to 104.6° F. Chloroquine therapy was started on the same day and his symptoms and findings cleared rapidly. A liver biopsy specimen obtained 3 weeks following the last chill revealed a normal liver.

*Case 7.* A 22-year-old man gave a history of shaking chills and fever, occurring every other day, while on board ship returning from Korea. One week later he noted anorexia, nausea, vomiting, and dark urine. A blood smear on board ship was reported as showing malaria, type not stated, and he was treated with chloroquine. He had a past history of chills and fever a year previously, successfully treated with chloroquine, although the diagnosis of malaria was not established at that time. On arrival at this hospital, 11 days after the onset, his temperature was 99.4° F. Repeated blood smears for malaria were negative. His hemoglobin was 11.6; serum bilirubin, 0.5 mg. per 100 cc.; thymol turbidity, 18; cephalin-cholesterol flocculation, 3 plus; prothrombin activity, 65 percent; serum cholesterol, 103 mg. per 100 cc.; cholesterol esters, 52 mg. per 100 cc.; serum albumin, 3.3 grams per 100 cc.; and serum globulin, 4.7 grams per 100 cc. His temperature dropped to normal immediately after admission and he remained asymptomatic without further treatment for the malaria. His liver profile returned to normal about 2 weeks after admission. A liver biopsy specimen taken on the twelfth hospital day revealed a normal liver.

*Case 8.* A 30-year-old man spent 11 months in Loyte in 1945, where he had an episode of fever, anorexia, dark urine, and jaundice which was treated with rest for 10 days. In January

1951, while on maneuvers in Louisiana, he noted the sudden onset of fever, with a temperature of 104° F., and generalized aching pain. He was hospitalized. One week later he became deeply jaundiced and a diagnosis of infectious hepatitis was made. He improved slowly and was not returned to duty until 28 July. On 24 August he was again hospitalized because of persistent pain in the right upper abdominal quadrant, appearing particularly with physical activity. Examination revealed a palpable and tender liver. Liver function tests were normal, but cirrhosis of the liver was considered and he was transferred to this hospital for further study. Examination here also revealed a slightly tender liver palpable 3 cm. below the right costal margin, a mild cervical and inguinal lymphadenopathy, and a temperature of 98° F. Blood smears disclosed *P. vivax*. His hemoglobin was 15.1; serum bilirubin, 0.5 mg. per 100 cc.; thymol turbidity, 6; cephalin-cholesterol flocculation, negative; serum cholesterol, 294 mg. per 100 cc.; serum albumin, 6.3 grams per 100 cc.; serum globulin, 3.4 grams per 100 cc.; and bromsulphalein retention, 1 percent in 45 minutes. A cholecystogram was normal. Repeated stool examinations failed to reveal any parasites or ova. Rectal biopsy showed no evidence of schistosomiasis. The patient remained afebrile. He was treated with chloroquine, following which his liver was no longer palpable and the malarial parasites disappeared from his blood. On discharge from the hospital he still complained of vague discomfort in the right upper abdominal quadrant, but this was much less marked than on admission.

A liver biopsy specimen obtained prior to the chloroquine therapy revealed small amounts of brown pigment in the cytoplasm of a few of the parenchymal cells and small foci of mononuclear cells scattered throughout the liver lobules (fig. 4). The Armed Forces Institute of Pathology reported minimal histologic changes of undetermined cause.

### DISCUSSION

Although this small series of patients with malaria is not statistically significant, it was hoped that comparing them with a group of patients with hepatitis would indicate differences suggesting lines for future profitable study. The zinc sulfate turbidity, thymol turbidity, cephalin-cholesterol flocculation, urine urobilinogen, and serum proteins were not significantly different in the 2 groups. The serum cholesterol averaged somewhat lower in the patients with malaria, but there was an overlap in the individual values. The initial serum bilirubin also tended to be lower in the patients with malaria, although low or even normal levels may occur in hepatitis.

stration of the malarial parasite; the leee marked elevation of the serum bilirubin level; and the absence of the characteristic histologic findings of hepatitis, as shown in needle biopsy specimen of the liver.

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## BOOKS RECEIVED

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*Cardiac Therapy*, by Harold J. Stewart, M. D., Associate Professor of Medicine, Cornell University Medical College, New York; Attending Physician, New York Hospital; Head of Division of Cardiology, Department of Medicine, New York Hospital-Cornell Medical Center. 622 pages; illustrated. Paul B. Hoeber, Inc., New York, N. Y., publisher, 1952. Price \$10.

*The Old Egyptian Medical Papyri*, by Chauncey D. Leake, Vice-President, University of Texas—Medical Branch, Galveston, Logan Clendenning Lectures on the History and Philosophy of Medicine, Second Series. 108 pages. University of Kansas Press, Lawrence, Kans., publishers, 1952. Price \$2.

*Sterility, Its Cause and Its Treatment*, by J. Jay Rommer, A. B., Ph. G., M. D., A. I. C. S., Gynecological Staff, Beth Israel Hospital, Newark, N. J.; Member; American Genetics Association, American Society for the Study of Sterility, New Jersey Neuropsychiatric Association, Fellow, New Jersey Obstetric and Gynecological Society. Part I-The Infertile Female, Part II-The Infertile Male. 424 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1952. Price \$12.50.

*Zinsser's Textbook of Bacteriology*, by David T. Smith, M. D., Professor of Bacteriology and Associate Professor of Medicine, Duke University School of Medicine; Norman F. Conant, Ph. D., Professor of Mycology and Associate Professor of Bacteriology, Duke University School of Medicine; Joseph W. Beard, M. D., Professor of Surgery in charge of Experimental Surgery, Duke University School of Medicine; Hilda Pope, Ph. D., Assistant Professor of Bacteriology, Duke University School of Medicine; D. Gordon Sharp, Ph. D., Assistant Professor of Biophysics in Experimental Surgery, Duke University School of Medicine; and Mary A. Poston, M. A., Instructor in Bacteriology, Duke University School of Medicine. 10th edition. 1,012 pages; illustrated. Appleton-Century-Crofts, Inc., New York, N. Y., publishers, 1952.

*Diabetic Glomerulosclerosis, The Specific Renal Disease of Diabetes Mellitus*, by Harold Riskin, M. D., F. A. C. P., Lecturer in Medicine, College of Physicians and Surgeons, Columbia University; Adjunct Attending Physician, Medical Division, Montefiore Hospital, Associate in Medicine and Assistant Professor, Department of Bacteriology, Flower-Fifth Avenue Hospitals, New York Medical College, New York, N. Y.; Louis Lester, M. D., Ph. D., Clinical Professor of Medicine, College of Physicians and Surgeons, Columbia University; Chief, Medical Division, Montefiore Hospital, New York, N. Y., and James Berkman, M. D., Instructor in Pathology, College of Physicians and Surgeons, Columbia University; Associate Pathologist, Montefiore Hospital, New York, N. Y. 102 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1952.

# EPIDEMIC HEMORRHAGIC FEVER<sup>(1)</sup>

CHARLES J. HORNISHER, Lieutenant Colonel, MC, U. S. A.

THOMAS W. INMON, Lieutenant Colonel, MC, U. S. A.

**E**PIDEMIC hemorrhagic fever is unfamiliar to most clinicians in the United States. It was first described in 1939 by Japanese military physicians stationed in the Songo district of Manchuria (2, 3). The disease also occurred in members of the Russian Army units operating along the Manchurian border (4). In 1943 the Japanese Army Medical Corps recognized the disease as an entity and officially named it epidemic hemorrhagic fever. The Japanese believed that it was caused by a virus; that the reservoir was the field mouse *Apodemus agrarius*; and that the vector was the mite, *Laelaps jettmari vitzthum*. Their data on the cause and transmission of the disease have as yet neither been confirmed nor disproved.

In June 1951 we began to observe patients in whom the clinical manifestations and the gross pathologic findings were consistent enough, from case to case, to indicate that we were dealing with a disease entity (5, 6). The consensus at that time was that we were dealing with an atypical form of leptospirosis and we were further misled by the erroneous identification of artefacts as leptospira in dark-field preparations of the serum of acutely ill and recently deceased patients. We were shortly disillusioned.

The microscopic studies on the tissues of animals injected with blood and urine of acutely ill patients and the postmortem tissues of human cases revealed no leptospira. Serial agglutin-

(1) From the Medical Service, 121st Evacuation Hospital, Korea.

(2) Takami, R. M.: Epidemic hemorrhagic fever. Mimeographed report of consolidated translations. Medical Section, GHQ, FEC, 13 Aug. 1951.

(3) Craig, J. P.: Epidemic hemorrhagic fever. Mimeographed report, 406th Medical Laboratory, Feb. 1951.

(4) Diathesis hemorrhagic and icterohemorrhagic leptospirosis. In Experience of Soviet Medicine in the Great War for the Fatherland. State Publishing House for Medical Literature, Vol. 24, chap. 3.

(5) Hornisher, C. J.: Epidemic hemorrhagic fever. Surgeon's Circular Letter, GHQ, FEC, VI, 10 Nov. 1951.

(6) Inmon, T. W.: Epidemic hemorrhagic fever. Information Bulletin, Office of the Surgeon, HQ EUSA, 29: 1, 1 Sept. 1951.

ations were not diagnostic for leptospirosis. The final blow to a diagnosis of leptospirosis was the demonstration of spiral forms in the dark-field studies performed on serums from normal persons who had had no possible exposure to the disease in the area from which we were receiving patients. All of the possibilities mentioned in the differential diagnosis were explored and discarded for want of objective confirmation. Having thus explored the familiar we were then prepared to explore the unfamiliar.

In February 1951 we had received a brief translation of Japanese descriptions of epidemic hemorrhagic fever from the 406th Medical General Laboratory in Japan. The manifestations of the disease in our patients were essentially the same as those described by the Japanese workers. From late June through early October we observed over 180 patients whose illnesses were sufficiently typical to permit a diagnosis of epidemic hemorrhagic fever. Our observations on these patients form the basis for this article.

### SYMPTOMS

Epidemic hemorrhagic fever is usually abrupt, but may be insidious in its onset. A prodromal stage lasting 1 or 2 days may occur with grippe symptoms, mild diarrhea, and general malaise. This is followed in rapid sequence by chills, fever, retrobulbar headaches, myalgia, and joint pains. Anorexia is present from the onset. Nausea and vomiting begin about the second day and persist for about a week. As the hemorrhagic tendency becomes more pronounced, hematemesis, hemoptysis, hematuria, and bloody diarrhea may appear. Abdominal pain is a constant complaint; it may be perumbilical or lower, but is most common in the upper abdominal quadrants. Sedation may be necessary for its relief. Low back pains and testicular pain may be present. Hiccups are an exhausting and annoying symptom. Most patients are restless, tense, and complain of insomnia and nightmares. Headache in the first 3 days is associated with transient periods of photophobia, blurring of vision, and myopia. Oliguria persists throughout the acute stage.

With convalescence a sudden diuresis may occur followed by urinary urgency and frequency, nocturia, and polydipsia of about 1 week's duration. Concurrently the appetite is ravenous. The duration of the disease is 1 or 2 weeks and in most patients recovery is complete in 3 weeks. Prolonged renal insufficiency has been noted in patients with a past history of nephritis. Occasionally stuttering is a sequela. Hemorrhages and ecchymosis disappear in 3 or 4 weeks. One of the outstanding features of the disease is the increase in severity of clinical signs and symptoms coincident with the disappearance of fever.

## PHYSICAL FINDINGS

The patient appears acutely ill from the onset of the disease until convalescence begins. The temperature rises abruptly to about 104° F., remains high for 3 or 4 days, then usually returns to normal by the seventh day. The skin of the face, neck, and chest is deeply flushed. The face and periorbital tissues are swollen and edematous. The skin is dry, perspiration appearing only with the onset of shock. A fine petechial rash may be seen on the chest, axilla, and wherever the clothing is tight. The pharynx is injected. The Rumpel-Leedo sign is positive in 3 or 4 minutes.

The bulbar and palpebral conjunctivas are suffused at the onset, later become injected, and small petechias occur which may coalesce forming ecchymosis's. Subconjunctival hemorrhage is one of the most frequent objective findings in our patients, but we have not observed the hemorrhagic involvement of the uvea and retina described by the Japanese workers. Epistaxis and bleeding from the gums are difficult to control. Ecchymosis appears at all sites of trauma to the skin. A single injection of medication, a tourniquet, or a sphygmomanometer cuff may cause ecchymosis of an entire extremity.

The physical findings of pneumonitis and pulmonary edema may be evident. Dyspnea and cyanosis due to pulmonary hemorrhage and consolidation pose a therapeutic problem. A fulminating pneumonia may result in death within 2 or 3 hours. A tachycardia accompanies the fever but cardiac arrhythmias are rare. Despite the abdominal pain, there is no localized tenderness. The liver and spleen are usually not palpable. The abdomen may become distended due to ileus. Deep palpation should be avoided because of the danger of increasing internal hemorrhage. At autopsy, rupture of the spleen and ecchymotic areas of the diaphragm, liver, stomach, bowel, and mesentery have been noted. In some fatal cases a sudden shocklike state may make its appearance, with marked peripheral vascular collapse. The pulse is rapid, the blood pressure is imperceptible; and the patient becomes cyanotic and restless. Such a patient may die within 2 or 3 hours. At autopsy gross pituitary hemorrhages are present.

## LABORATORY FINDINGS

*Urine.* Albuminuria of from 1 to 4 plus appears within from 28 to 72 hours, persists for 1 week, and subsides during the ensuing 2 weeks of convalescence. The specific gravity falls to from 1.002 to 1.005 in the first week of illness and the patient regains his ability to concentrate during the 2 weeks of convalescence. Microscopic to gross hematuria is present early

but usually clears within 2 weeks. Granular, waxy, and erythrocytic casts accompany clinical improvement.

**Blood.** The leukocyte count is normal or a leukopenia may be present early to be followed by a rapidly rising count within the following 2 or 3 days. In most patients the count reaches about 30,000 but occasional counts of 100,000 are seen. In some patients the leukocytosis may last only 48 hours. The

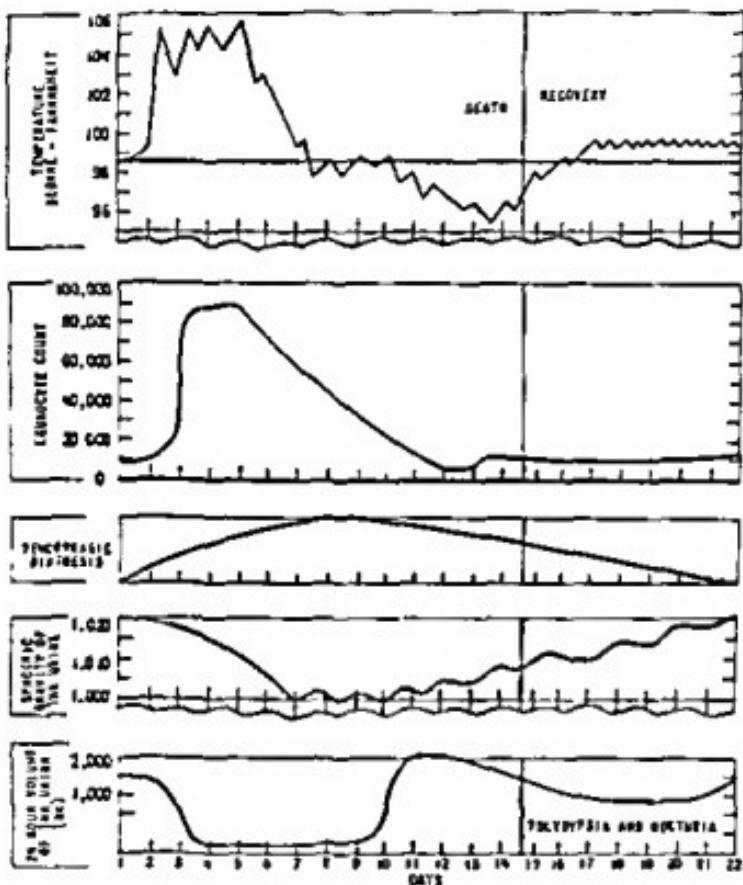


Figure 1. Graphic representation of time relationships of various manifestations.

differential count is 70 to 80 percent neutrophils; 15 to 20 percent lymphocytes; and 5 to 10 percent monocytes. About 25 percent of the lymphocytes are atypical. There is a relative absence of eosinophils during the acute phase of the disease, but they appear again on convalescence. We have not observed the eosinophilia described by the Japanese workers.

There is a decrease in platelets to about 100,000 per cu. mm. in the first week, then a return to normal. The erythrocyte count, hemoglobin, and hematocrit are above normal levels in the same period. Bleeding, coagulation, and clot retraction times are

normal. The patients' prothrombin time is from 20 to 40 seconds (control 14), returning to normal in 2 weeks.

*Blood chemistry.* The nonprotein nitrogen is elevated by about the sixth day to from 60 to 80. It returns to normal as the kidneys regain their ability to concentrate urine.

*Serology.* The serologic test for syphilis, Weil-Felix and Widal agglutinations, and heterophile antibody reaction are negative. Agglutination against 12 strains of leptospira has also been repeatedly negative. Dark-field examination of the blood and urine is negative for leptospira and borrelia. Malaria smears are occasionally positive, but treatment of the malaria does not alter the course of the disease. The sedimentation rate is not increased at the onset but may show a slight rise later.

*Spinal puncture* may reveal normal or bloody fluid. The pressure is normal.

Figure 1 shows the time relations of various manifestations.

### DIAGNOSIS

As in most infectious diseases, the severity and duration of the symptoms and signs are variable from patient to patient. On the other hand, some objective findings are observed consistently enough to form a reasonable basis for diagnosis. The most consistent objective findings are subconjunctival hemorrhage, leukemoid leukocytosis, oliguria, and albuminuria. An increase in the severity of these and other signs coincident with defervescence is also diagnostic.

In the differential diagnosis the following diseases should be ruled out: (1) leptospirosis, (2) purpura, (3) acute meningoococcemia, (4) hemorrhagic smallpox, (5) sand fly fever, (6) subacute bacterial endocarditis, (7) relapsing fever, (8) epidemic typhus, (9) acute myelogenous leukemia, and (10) drug and chemical poisoning.

### COMPLICATIONS

Complications include prostatitis, orchitis, pancreatitis, hepatitis, encephalitis, and bladder paralysis. Recovery of the ability to concentrate urine is delayed in some patients.

### PROGNOSIS

In patients with a past history of renal disease, convalescence may be prolonged. Obesity adversely affects the prognosis. The average patient can be returned to duty in about 3 weeks. The mortality is about 13 percent. The principal causes of death are hemorrhage into the pituitary, lungs, and kidneys; peripheral vascular collapse; and uremic coma. It is difficult to give a

prognosis because some patients who were very ill and seemed to be poor risks made a dramatic recovery within 24 hours and others who seemed only mildly ill died within 12 hours or less.

### GROSS PATHOLOGY

The most frequent gross pathologic findings are hemorrhage and edema, which may involve any organ or system but are most commonly present in the kidney and surrounding retroperitoneal tissues, upper gastrointestinal tract, lungs, wall of the right atrium, and the pituitary and its stalk. The appearance of the kidney is striking. The medulla is dark red and hemorrhagic and the cortex is edematous and pale. This appearance was previously noted by Japanese workers as a consistent finding.

### TREATMENT

The treatment, in general, is symptomatic and supportive. Clothing should be loose. Trauma accompanying injections, numerous laboratory procedures, and deep palpation should be avoided. A liquid diet is given. Cold liquids and carbonated beverages are fairly well tolerated in small quantities. Narcotics and sedatives are given as indicated. A maximum of 500 cc. of 10 percent dextrose in water containing 70 mg. of vitamin K and 200 mg. of vitamin C is administered intravenously. The tendency toward sudden edema renders fluid restriction mandatory during the first 7 to 10 days of the disease. ACTH and cortisone are given for shock as indicated, but the results have not been striking. Oxygen, blood, epinephrine, and other supportive measures are used as indicated. Transfusions of from 250 to 500 cc. of whole blood obtained from patients in their third week of illness were given to about 70 of our patients. It is our impression that this measure is helpful if administered during the first 5 days of the illness. It is emphasized that this is our impression and not a statistically supportable fact.

The following drugs and antibiotics have not proved beneficial: penicillin, streptomycin, surcomycin, terramycin, chloramphenicol, sulfadiazine, and 4-aminoquinoline compounds.

### SUMMARY

Epidemic hemorrhagic fever is an acute infectious disease, possibly caused by a virus and characterized by an abrupt onset, chills, fever, retrobulbar headache, myalgia, vomiting, abdominal pain, hemorrhagic phenomena, leukocytosis, and albuminuria, and increase in symptoms and signs with defervescence. The lesions consist predominantly of hemorrhages involving any system or combination of systems but most frequently the kidney, pituitary, muscles, and gastrointestinal tract. No distinctive microscopic lesions have been recognized.

# CLINICAL SIGNIFICANCE OF ANTI-RH ANTIBODY DETERMINATIONS<sup>(1)</sup>

WILLIAM L. BOND, *Lieutenant, junior grade, MC, U. S. N. R.*

EDWARD T. KNOWLES, *Captain, MC, U. S. N.*

JOHN J. ENGELFRIED, *Commander, MSC, U. S. N.*

**A**LTHOUGH the recent literature contains innumerable reports concerning the various Rh and Hr agglutinogens, there still remains much confusion as to the clinical significance and application of anti-Rh antibody determinations. Anti-Rh antibodies are not normally present in the blood. They occur only as a result of immunization. Immunization is produced by the introduction of Rh agglutinogens into susceptible persons, usually as a result of pregnancies or transfusions. The intramuscular injection of blood as previously practiced for therapeutic purposes may also produce immunization. One instance of sensitization due to the intramuscular injection of human serum has been reported by Wallace et al. (2).

Wiener and Sonn-Gordon (3) have immunized male volunteers by only 2 successive parenteral injections of Rh agglutinogens. Although the interval of rest between these injections was 4 months, they found this would produce immunization in only 40 percent of the persons tested. These workers postulated that 1 injection was necessary to prime the reticuloendothelial system, then after 3 or 4 months of rest the second injection would result in antibody formation if the person were susceptible. It is estimated that there is a 1:3 chance of fetal blood passing into the maternal circulation during pregnancy and a 1:3 chance during parturition (4). As would be expected, primigravidae without previous injections of Rh agglutinogens rarely deliver erythroblastotic infants.

Three varieties of anti-Rh antibodies are generally recognized: saline-active agglutinins, serum-albumin agglutinins, and block-

(1) U. S. Naval Hospital, Oakland, Calif.

(2) Wallace, J. T.; Wiener, A. S.; and Doyle, M. H.: Rh sensitization in primipara caused by intramuscular injection of human serum resulting in fatal erythroblastosis. Am. J. Obst. & Gynec. 56: 1163-1167, Dec. 1948.

(3) Wiener, A. S., and Sonn-Gordon, E. B.: Simple method of preparing anti-Rh serum in normal male donors. Am. J. Clin. Path. 17: 67-70, Jan. 1947.

(4) Wiener, A. S.; Nappi, R.; and Gordon, E. B.: Studies in Rh sensitization; effect of Rh-positive pregnancies on Rh antibody titer. Blood 6: 789-798, Sept. 1951.

ing antibodies. The saline-active agglutinins will agglutinate Rh-positive cells suspended in saline solution. The serum-albumin agglutinins agglutinate Rh-positive cells suspended in serum albumin. Blocking antibodies are attached to the erythrocytes but do not produce clumping and are detected by means of an indicator. A possible fourth variety, the cryptagglutinoids, as described by Hill et al. (5), are globulin antibodies which coat the erythrocytes and react with rabbit antihuman globulin serum. This is the antibody demonstrable by the Coombs test. All types act *in vitro* to produce agglutination whereas in vivo they result in hemolysis.

Diamond and Denton (6) stated that saline agglutinins are the first to appear as a result of sensitization whereas serum-albumin agglutinins and blocking antibodies are evident only after prolonged immunization. The more severe forms of hemolytic disease are usually found in the offspring of women whose blood contains serum-albumin agglutinins and blocking antibodies. Wiener (7) postulated that the smaller blocking antibodies and serum-albumin agglutinins traverse the placenta more readily than the larger saline-active agglutinins. He found an 8 percent incidence of stillbirths associated with maternal serums containing high titers of only saline-active agglutinins. Maternal serums having high titers of serum-albumin agglutinins and blocking antibodies were associated with a 43.9 percent incidence of stillbirths.

Davidson and Stern (8) found significant correlation between serum-albumin agglutinin titers, with or without blocking antibodies, and fetal death. They reported a 72 percent fetal salvage when the serum-albumin agglutinin titers were less than 1:10 and blocking antibodies were not present. If blocking antibodies were present the salvage was reduced to 57 percent. When the maternal serums contained titers of serum-albumin agglutinins in excess of 1:10 without blocking antibodies, only 39 percent of the infants survived. If, however, blocking antibodies were present, this salvage was reduced to 28 percent.

Page et al. (9) found that the duration of exposure of the fetus to maternal antibodies was of possible prognostic value. All stillbirths in the patients they investigated were associated with

(5) Hill, J. M., Haberman, S., and Jones, F.: Hemolytic Rh immune globulins, evidence for possible third order of antibodies incapable of agglutination of blocking. *Blood, Spec. Issue No. 2*, pp. 80-100, Jan. 1948.

(6) Diamond, L. K., and Denton, R. L.: Rh agglutination in various media with particular reference to value of albumin. *J. Lab. & Clin. Med.* 30: 821-830, Oct. 1945.

(7) Wiener, A. S.: Pathogenesis of erythroblastosis fetalis; statistical evidence. *Am. J. Clin. Path.* 16: 761-767, Dec. 1946.

(8) Davidson, L., and Stern, K.: Interpretation of Rh antibodies. *Am. J. Clin. Path.* 18: 690-699, Sept. 1948.

(9) Page, E. T., Hunt, W. L., and Lucia, S. P.: Antepartum prediction of hemolytic disease of newborn. *Am. J. Obst. & Gynec.* 52: 794-796, Nov. 1946.

demonstrable antibodies in the maternal serum for a period of 15 weeks or more prior to delivery.

Once established, maternal immunization is permanent and all Rh-positive children born after the delivery of 1 erythroblastotic infant will usually manifest hemolytic disease (10). Davidsohn (11) found the titer of anti-Rh agglutinins in the blood of mothers with erythroblastotic children to be highest from 8 to 20 days following delivery. Wiener et al. (12) found that all sensitized persons presented antibodies for at least 4 years following delivery when enzyme-treated cells were used in the determinations. Halac (13) was able to demonstrate antibodies in 1 patient 33 years following her last pregnancy.

At this hospital, 2,678 patients were delivered in 1951. Three hundred and thirty-one (12.4 percent) of these were Rh<sub>O</sub> negative. There were 39 Rh<sub>O</sub>-negative patients married to Rh<sub>O</sub>-negative husbands, which approximates the expected ratio of 1:7. There were 190 multigravidae and 141 primigravidae. Anti-Rh antibody determinations were performed on all Rh-negative patients married to Rh-positive husbands at every prenatal visit regardless of previous pregnancies or transfusions. Many of these patients were followed elsewhere and seen at this hospital only during the last 4 weeks of pregnancy.

#### PROCEDURE FOR ANTI-RH ANTIBODY DETECTION

An approximate 1 percent cell suspension was prepared from 5 or more group "O" Rh<sub>O</sub>-positive specimens of fresh clotted blood. These cells were suspended in pooled fresh plasma which was fortified with 25 percent concentrated albumin. Aliquots of each cell suspension were incubated for 2 hours at 37° C. and shaken intermittently. After incubation, a large drop of the contents of each tube was transferred to a Boerner slide. This was rotated for 10 minutes, then read microscopically. Both a positive and a negative serum control were included. If this presumptive test was positive, the serum was titrated by making serial dilutions with the fortified plasma diluent. The pooled type "O" Rh<sub>O</sub>-positive cells were added to the serum dilutions and incubated for 2 hours.

(10) Potter, E. L.: Rh: Its Relation to Congenital Hemolytic Disease and to Intragroup Transfusion Reactions. Year Book Publishers, Inc., Chicago, Ill., 1947.

(11) Davidsohn, I.: Rh antibodies. Am. J. Clin. Path. 15: 95-105, Mar. 1945.

(12) Wiener, A. S.; Nappi, R.; and Gordon, E. B.: Studies in Rh sensitization; persistence of Rh antibodies in serum of sensitized individuals. Blood 6: 799-803, Sept. 1951.

(13) Halac, E.; Linarez Garzon, M.; and Ottero de Sacchetti, M. O.: Isoimmunización por el factor Rh; estudio sobre su duración en estado activo. Arch. argent. de pediat. 30: 1-9, 1948. Cited in footnote reference (12).

delivered an icteric infant who had 13 grams of hemoglobin and 4.1 million erythrocytes. There were 5 nucleated erythrocytes per 100 leukocytes. Two hours after birth an exchange transfusion of 425 cc. of type "A" Rh<sub>o</sub>-negative blood was given. On 31 January an additional 90 cc. of blood were given. The child made an uneventful recovery and was discharged on 14 February.

*Case 9.* The estimated date of confinement of a 19-year-old white para 0 gravida 1 was 21 October 1951. A left nephrectomy had been performed elsewhere after 3 months' gestation and a transfusion had been given. This patient was transfused with "O" Rh<sub>o</sub>-positive blood. Her husband was Rh<sub>o</sub> positive. Antibody titers were as follows: 22 June, negative; 27 July, questionable; 17 August, 1:64; 31 August, and 7 and 14 September, 1:128; 21 and 28 September, and 5, 12, and 19 October, 1:256; and 24 October, 1:64. The patient delivered an apparently normal infant on 24 October, but the infant's serum contained anti-Rh antibodies. Icterus developed on the first day of life and the hemoglobin was found to be 14.5 grams with 5.1 million erythrocytes. No nucleated erythrocytes were present. The icterus did not increase and on 27 October the hemoglobin was 16 grams and there were 5.6 million erythrocytes. The infant was discharged in good condition. On 13 March 1952 examination of the maternal serum revealed an antibody titer of 1:64.

*Case 10.* The estimated date of confinement of a 26-year-old white para 2 gravida 3 was 30 December 1951. Her husband was Rh<sub>o</sub> positive and her 2 children had been apparently normal. Antibody titers were as follows: 30 November and 7 December, negative; and 14 December, 1:128. Labor was induced by amniotomy on 20 December. She delivered on the same day and an antibody titer following delivery was reported as 1:1,024. This infant had a mild icterus. The hemoglobin was 9.5 grams with 3.2 million erythrocytes. There were 52 nucleated erythrocytes per 100 leukocytes and the infant's serum had an anti-Rh antibody titer of 1:16. A transfusion of 75 cc. of type "A" Rh-negative blood was given and the hemoglobin increased to 14 grams with 4.7 million erythrocytes. There were, however, 180 nucleated erythrocytes per 100 leukocytes. On 22 December the icterus had increased and edema developed. An exchange transfusion was started but the infant died during the procedure. Autopsy confirmed the diagnosis of erythroblastosis and, in addition, atelectasis was present.

*Case 11.* The estimated date of confinement of a 21-year-old white para 0 gravida 1 was 10 July 1951. Her husband was Rh<sub>o</sub> positive. She had received no transfusions. Antibody titers were

as follows: 9 May, negative; 13 June, 1:32; 20 June, 1:2; and 27 June and 6 July, 1:4. She delivered a normal infant on 16 July who showed no evidence of hemolytic disease. The Rh factor was not determined for the infant.

### DISCUSSION

Of the 2 primigravidas in this series, 1 had received blood. The other gave no history of previous blood transfusion, but the intramuscular injection of blood during infancy could not be excluded. Only 2 of the sensitized patients in this series delivered normal infants. Case 4 delivered an Rh-negative infant and the demonstrable antibodies probably were a carry-over from a previous pregnancy, or this could be an instance of an anamnestic reaction. The  $Rh_0$  factor was not determined in the other infant whose mother's antibody titrations never exceeded 1:32. No infants were delivered in this 1-year period with hemolytic disease due to Rh incompatibility in which anti-Rh antibodies were not demonstrable in the maternal serum.

Of the 9 infants exhibiting hemolytic disease, 3 were hydropic stillbirths. The mothers of these 3 had serum-albumin agglutinins and blocking antibody titers of 1:256 or higher. The remaining 8 patients had titers of 1:256 or less. Four of these infants required multiple or exchange transfusions. Only one infant expired and it might have survived had exchange transfusions been performed immediately after birth.

One patient (case 5) received cortisone therapy during the last 4 weeks of her pregnancy. Her infant was treated with cortisone as well as with an exchange transfusion.

The significance of a single antibody determination is difficult to interpret. Repeated examinations are necessary in order to predict the possible presence of hemolytic disease in the infant and, in some cases, the severity of the disease. Even with repeated examinations, an accurate prognosis may be difficult. An increasing antibody titer may not signify that the pregnancy will terminate in the delivery of an infant with hemolytic disease. An Rh-negative infant in utero can result in a rising maternal titer by producing an anamnestic reaction (14). On the other hand, a persistently low titer may not indicate the delivery of an infant free of erythroblastosis, but, in general, constant and marked titer increases are associated with erythroblastotic infants. A titer that suddenly drops may be of great significance. This may indicate fetal death or increased absorption of antibodies by the fetus or placenta, but in anamnestic reactions and with carry-

(14) Schneider, C. L.: Frequency of Rh anamnestic reaction during pregnancy. Am. J. Obst. & Gynec. 59: 371-377, Feb. 1950.

over antibodies from previous immunizations, titer decreases may be of no prognostic significance.

An absolute prediction of the survival of a fetus in utero cannot be made on the basis of antibody determinations. Antibody titrations will, however, suggest the possibility of hemolytic disease being present in the newborn so that adequate preparation can be made for the care of these infants following delivery. In selected cases, labor can be induced near term. The elective termination of pregnancy prior to the thirty-sixth week of gestation on the basis of antibody determinations is unwarranted.

Antibody determinations are indicated in all Rh-negative maternity patients who are married to Rh-positive husbands. Primigravidas without previous blood transfusions may have had intramuscular injections of blood and it may be difficult to elicit a history of self- or criminally-induced abortion. For correct interpretation, an antibody determination should be made early in pregnancy. Antibodies which are found during the first trimester are as a rule the result of previous immunization. Another determination should be made during the thirty-third or thirty-fourth week and another during the thirty-eighth week of pregnancy. If a patient presents evidence of a history of immunization, anti-Rh antibody titrations are indicated every 2 weeks until the last month of pregnancy, then twice weekly. Davidsohn (15) recommends determinations at 1- or 2-month intervals until the seventh month, then at biweekly intervals. Browne (16) makes antibody determinations only at monthly intervals during the last half of pregnancy in primigravidas and in multigravidas at monthly intervals after the fourth month of gestation.

### SUMMARY

Three hundred and thirty-one (12.4 percent) of the obstetrical patients delivered at this hospital in 1951 were  $Rh_0$  negative. Two hundred and twenty-nine of these  $Rh_0$ -negative patients were married to  $Rh_+$ -positive husbands. Eleven (4.5 percent) of these 229 patients were sensitized. Nine of these 11 patients delivered infants who had hemolytic disease. Three were hydropic stillbirths. Only 1 neonatal death occurred. The ultimate outcome of pregnancy could not be absolutely predicted on a basis of antibody determinations.

(15) Davidsohn, I.: Rh antibodies; correlation with clinical findings. *Blood*, Spec. Issue No. 1, pp. 135-154, Jan 1948.

(16) Browne, T. H.: Significance of gynecology and obstetrics; present status of management of Rh-negative pregnant woman. *S. Clin. North America* 30: 165-174, Feb 1950.

# PSEUDOMONAS AERUGINOSA MENINGITIS

Report of Case Treated With Terramycin (1)

PHILIP TROEN, Captain, MC, U. S. A. R.

JOSEPH M. DiCAPRIO, First Lieutenant, MC, U. S. A. R.

WITH each new antibiotic the spectrum of unresponsive bacteria has been steadily narrowed. Among the bacteria still generally resistant to such treatment is *Pseudomonas aeruginosa*. Although not ordinarily a pathogen, it may cause infection if the resistance of the host is lowered. As Jawetz (2) pointed out, when the natural defenses of the body have not yet appeared, as in infants; have failed, as in debilitated persons; or when entrance is gained by the bacillus into areas lacking natural defenses, then infection, which is often chronic, disabling, and sometimes fatal, may result. *Ps. aeruginosa* has thus aptly been called an opportunist.

Invasion of the meninges by this organism results in a serious condition. The organism may be introduced by a lumbar puncture needle or less frequently by bacteremia from some focus of infection. The treatment of meningitis due to *Ps. aeruginosa* has been extremely difficult. The use of various antibiotics, including streptomycin and polymyxin, has met with varying success. The following case is reported because of the successful use of terramycin intravenously and because of various observations made during the treatment.

## CASE REPORT

A 20-year-old man was admitted to this hospital on 29 November 1951. On 24 November, in North Korea, he was wounded in the left buttock by an enemy shell fragment. The wound was debrided under intravenous pentothal anesthesia and the patient was evacuated to Japan.

On admission physical examination revealed a wound of the lateral aspect of the left buttock, measuring 11 by 19 cm. and exuding purulent material. Wet dressings were applied to the wound and 300,000 units of procaine penicillin were given

(1) U. S. Army Hospital, 8163d Army Unit.

(2) Jawetz, E.: Infections with *Pseudomonas aeruginosa* treated with polymyxin. *B. Arch. Int. Med.* 89: 90-98, Jan. 1952.

On the seventy-second postoperative day slow ambulation and mild physical therapy for the loss of muscle strength and substance were started. The patient remained afebrile and asymptomatic. His pulse rate slowly returned to normal. His sedimentation rate continued to be elevated. His spinal fluid remained clear, showing on the eightieth postoperative day slightly elevated pressure, moderate pleocytosis (24 lymphocytes), and elevation of the protein content (98 mg. per 100 cc.). Satisfactory progress was maintained until the ninety-second postoperative day, 6 weeks after treatment was stopped, when he developed a pleuritic pain in the left upper anterior portion of his chest. A roentgenogram of his chest revealed a small area of increased density in the second left anterior interspace. During the next few days, this cleared completely and he again became asymptomatic. His pulse rate remained normal, his sedimentation rate returned to normal, and by the start of his fourth postoperative month he was fully ambulatory, afebrile, and asymptomatic.

### DISCUSSION

This case is of interest for 3 reasons. First, meningitis due to *Ps. aeruginosa* was successfully treated with large intravenous doses of terramycin. Although minimal pleocytosis and elevated protein were still present in the spinal fluid 1 month after treatment was stopped, the negative cultures and the afebrile, asymptomatic clinical course leave no doubt that the infection had been eradicated. This suggests that large doses of terramycin are useful in the treatment of such infections. The intravenous use of terramycin may not be without hazard, but it will extend the available armamentarium.

The second point of interest is the information obtained concerning the administration of varying concentrations and dosages of terramycin given intravenously. Because of the nausea and vomiting, terramycin could not be given by mouth. With the dosage initially used, there was some immediate improvement, but then a balance seemed to result between the infection and the terramycin. Sensitivity studies revealed marked resistance of the organisms to terramycin *in vitro*. With the sudden change in the patient's condition on the thirty-fifth postoperative day, it became necessary to try a different therapeutic approach. Because polymyxin was not available, it was decided to exceed what had been considered a safe dosage and increase the amount of terramycin given to 6 grams intravenously each day. Fortunately this was successful and no serious evidences of toxicity developed. In daily doses of 1 or 2 grams in 1 or 2 liters of fluid respectively, no difficulty in the administration of terramycin was encountered over a 25-day period, but when a continuous intravenous infusion of 3 liters per day containing 2

grams of terramycin per liter was given, phlebitis rapidly developed. When the concentration was reduced to 1.5 grams per liter and 4 liters were given per day, the development of phlebitis was markedly slowed. Throughout the entire course, nausea, anorexia, and vomiting accompanied the intravenous use of terramycin. When treatment was stopped, these symptoms promptly disappeared.

The third point of interest is the development of a persistent tachycardia and T-wave changes during intensive intravenous terramycin therapy. These slowly subsided. Whether the tachycardia and T-wave changes were part of the course of the disease or were caused by the terramycin therapy cannot be stated.

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**EDITOR'S NOTE:** On page 194 of *Annals of Internal Medicine*, July 1952, Ginsberg, I. A., and Hyman, G. A., report the successful treatment of a patient with *Ps. aeruginosa* meningitis with combined aureomycin and streptomycin; and on pages 1395-1397 of the *Journal of the American Medical Association*, Aug. 9, 1952, Knight, V.; Hardy, R. C.; and Negrin, J., Jr., report the successful intrathecal use of streptokinase and streptodornase and intramuscular and intrathecal use of neomycin in meningitis due to *Ps. aeruginosa*.

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*Brain Mechanisms in Coronary Disease, Causation, Treatment, and Prevention*, by N. E. Ischblondsky, M. O., Author of *Brain and Behaviour*; *Protoformotherapy in Treatment and Prevention*; *Der Bedingte Reflex und Seine Bedeutung*; *Physiologische Grundlagen der Tieftenspsychologie*, etc. With Two Appendices: 1. From the Conditioned Reflex to the Science of Brain Dynamics. Paper delivered at the XVIITH International Congress of Physiology. 2. Reflexologic Bases of Personality. Paper delivered at the Ninety-Sixth Annual Meeting of the American Psychiatric Association. 171 pages; illustrated. Henry Kimpton, London, England, publisher, 1952.

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Physical Foundations of Radiology, by Otto Glasser, Professor of Biophysics and head of Department of Biophysics, Cleveland Clinic Foundation, Cleveland, Ohio; Edith H. Quimby, Associate Professor of Radiology (Physics), College of Physicians and Surgeons, Columbia University, New York; Lauriston S. Taylor, Chief, Atomic and Radiation Physics Division, National Bureau of Standards, Washington, D. C.; J. L. Weatherwax, American Oncologic Hospital and Graduate School of Medicine, University of Pennsylvania, Philadelphia. 2d edition, revised and enlarged. 581 pages, illustrated. Paul B. Hoeber, Inc., New York, N. Y., publisher, 1952. Price \$6.50.

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Pictorial Handbook of Fracture Treatment, by Edward L. Campere, M. D., F. A. C. S., Associate Professor of Surgery, Northwestern University Medical School; Chairman, Departments of Orthopedic Surgery, Wesley Memorial and Children's Memorial Hospitals, Consultant in Orthopedics, Chicago Memorial and Illinois Hospitals, Medical Adviser and Director, Rehabilitation Center of the Liberty Mutual Insurance Company, Chicago, and Sam W. Banks, M. D., F. A. C. S., Associate Professor in Surgery, Northwestern University Medical School, Attending Orthopedic Surgeon, Chicago Memorial, Woodlawn and Illinois Veterans Hospitals, Chicago. Revised with the assistance of Clinton L. Campere, M. D., F. A. C. S., Assistant Professor of Surgery, Northwestern University Medical School, Attending Orthopedic Surgeon, Wesley Memorial Hospital, Consultant in Orthopedic Surgery, Augustana Hospital; Senior Consultant, Veterans Administration, Chicago. 424 pages; illustrated. The Year Book Publishers, Inc., Chicago, Ill., 1952. Price \$6.50.

Rypins' Medical Licensure Examinations, Topical Summaries and Questions, by Walter L. Biering, M. D., F. A. C. P., M. R. C. P., Edin. (Hon.). Former Member, National Board of Medical Examiners, American Board of Internal Medicine, Iowa State Board of Medical Examiners, Professor Emeritus, Theory and Practice of Medicine, College of Medicine, State University of Iowa; Secretary, Federation of State Medical Boards of the United States; Chairman, American Board of Preventive Medicine and Public Health, Iowa State Commissioner of Health, with the Collaboration of a Review Panel. 7th edition. 856 pages. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1952.

Laboratory Technique in Biology and Medicine, by E. V. Cowdry. Research Professor of Anatomy and Director Ternse Cancer Research Laboratory, Washington University, St. Louis. 3d edition. 382 pages. The Williams & Wilkins Co., Baltimore, Md., publishers, 1952. Price \$4.

The Esophagus and its Diseases, by Eddy D. Palmer, M. D., F. A. C. P., Lieutenant Colonel, Medical Corps, United States Army; Chief, Gastrointestinal Section, Walter Reed Army Hospital, Consultant in Gastroenterology to the Surgeon General. Illustrations by Phyllis Anderson. 553 pages; illustrated. Paul B. Hoeber, Inc., New York, N. Y., publisher, 1952. Price \$15.

# HISTOCHEMICAL DETECTION OF FATAL ANTICHOLINESTERASE POISONING

A. DOROTHY BERGNER, *Pb. D.*

MILWARD W. BAYLISS, *Colonel, MC, U. S. A. (1)*

HERE has been a recent increase in the use of chemicals which act as cholinesterase (ChE) inhibitors. These anticholinesterases include therapeutic agents, such as those used in the treatment of myasthenia gravis (2-7) and certain insecticides. In cases of poisoning by such agents, the clinical syndrome is well defined and, in general, similar to acetylcholine intoxication (3-6, 8-10). On the other hand, at necropsy the findings are nonspecific and consist only of pulmonary and cerebral edema accompanied by petechial hemorrhage in the aerous membranes and viscera. Ordinary toxicologic procedures cannot be relied on because the amount of toxic material absorbed in fatal cases is small and because the compounds tend to hydrolyze in the body fluids.

(1) From the Chemical Corps Medical Laboratories, Army Chemical Center, Md.

(2) Schleizinger, N. S.: Present status of therapy in myasthenia gravis. *J. A. M. A.* 148: 508-513, Feb. 16, 1952.

(3) Stone, C. T., and Rider, J. A.: Treatment of myasthenia gravis. *J. A. M. A.* 141: 107-111, Sept. 10, 1949.

(4) Comroe, J. H., Jr., Todd, J.; Gammon, G. D.; Leopold, L. H.; Koelle, G. B.; Bodansky, D.; and Gilman, A.: Effect of di-isopropylfluorophosphate (DFP) upon patients with myasthenia gravis. *Am. J. M. Sc.* 212: 641-651, Dec. 1946.

(5) Harvey, A. M.; Lilienthal, J. L., Jr., Grob, D.; Jones, B. F.; and Talbot, S. A.: Administration of di-isopropyl fluorophosphate to man; effects on neuromuscular function in normal subjects and in myasthenia gravis. *Bull. Johns Hopkins Hosp.* 81: 267-292, Oct. 1947.

(6) Grob, D., and Harvey, A. M.: Observations on effects of tetramethyl pyrophosphate (TEPP) in man, and on its use in treatment of myasthenia gravis. *Bull. Johns Hopkins Hosp.* 84: 532-567, June 1949.

(7) Rider, J. A.; Schulman, S.; Richter, R. B.; Moeller, H. C.; and DuBois, K. P.: Treatment of myasthenia gravis with octamethyl pyrophosphamide; preliminary report. *J. A. M. A.* 145: 967-972, Mar. 31, 1951.

(8) Abrams, H. K., Hamblin, D. D.; and Marchand, J. F.: Pharmacology and toxicology of certain organic phosphorus insecticides: clinical experience: Council on Pharmacy and Chemistry. *J. A. M. A.* 144: 107-108, Sept. 9, 1950.

(9) Grob, D.; Garlick, W. L.; Merrill, G. G.; and Freimuth, H. C.: Death due to parathion, an anticholinesterase insecticide. *Ann. Int. Med.* 31: 899-904, Nov. 1949.

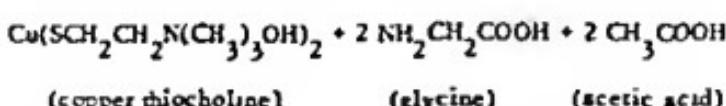
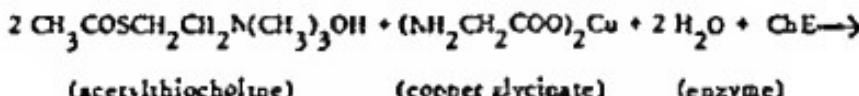
(10) Grob, D.; Garlick, W. L.; and Harvey, A. M.: Toxic effects in man of anticholinesterase insecticide parathion (*p*-nitrophenyl diethyl thionophosphate). *Bull. Johns Hopkins Hosp.* 87: 106-129, Aug. 1950.

In the absence of reliable pathologic or toxicologic procedures, some method is needed for determining the cause of death in cases of suspected anticholinesterase poisoning. Such a method must depend on demonstration by either a manometric or histochemical technic of inhibition of the enzyme, ChE, in the post-mortem material. In reports of fatal parathion poisoning, manometric determinations of ChE activity in blood and tissues removed at necropsy have been reported (9, 10).

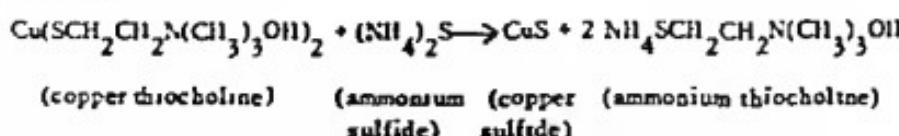
That a histochemical method also is available was indicated recently (11). As a result of experiments using mouse and human tissue removed at necropsy, it was shown that a histochemical method for the demonstration of active ChE in tissues can be applied to postmortem material for the detection of acute anti-cholinesterase poisoning. The method followed was the histochemical technic of Koelle and Friedenwald for localizing ChE activity in teased or frozen sections of unfixed tissues (12, 13).

Cholinesterases are enzymes which hydrolyze carboxylic acid esters of choline. Koelle and Friedenwald used acetylthiocholine as a substrate because it is hydrolyzed more rapidly than acetylcholine by both specific and nonspecific esterases. In their method acetylthiocholine is hydrolyzed in the presence of copper glycinate. Copper thiocholine is formed at the site of enzymatic action. This white precipitate reacts with dilute ammonium sulfide to produce dark brown copper sulfide which is easily visible. The chemical reactions are:

#### **Reaction L**



### **Reaction 2**



(11) Bergner, A. D., and Dulacher, S. H.: Histochemical detection of fatal acetylcholinesterase poisoning. Am. J. Path. 27: 1011-1021, Nov.-Dec. 1951.

(12) Koelle, G. B., and Friedewald, J. S.: Histochemical method for localized cholinesterase activity Proc. Soc. Exper. Biol. & Med. 70: 617-622, Apr. 1949.

(13) Koelle, G. B. Histochemical differentiation of types of cholinesterases and their localizations in tissues of cat. J. Pharmacol. & Exper. Therap. 100: 158-179, Oct. 1952.

Because possible diffusion of the copper thiocholine is kept at a minimum, if not entirely suppressed, the presence of a deposit of CuS indicates a site of ChE activity. In striated muscle the site of the motor end plate is clearly differentiated from the muscle fiber, as shown in figure 1. When enzymatic action is inhibited, there is no deposit at the site. Without such a deposit the motor end plate cannot be distinguished from the muscle fiber.

### MODIFICATION OF TECHNIC

The procedure followed in adopting the Koelle-Friedewald technic for use in cases of fatal poisoning was dictated by the nature of the problem, namely, the need for a simple method which could be applied to postmortem material. Preliminary runs with biopsy specimens showed that the method was reasonably simple to perform and gave reproducible results on repetition.

The method was simplified by limiting the choice of tissue to striated muscle. This muscle is easy to obtain and, if the sample contains fibers an inch long for human material (shorter for smaller animals, depending on their size), should include some motor end plates. A further advantage lies in the fact that these fibers can be teased apart easily and are easy to handle during the test for ChE activity. The necessity of making frozen sections of unfixed tissues is avoided. Thus the advantages of testing unfixed material are retained but the danger of adsorption artefacts is avoided. Advantage was also taken of the fact that in striated muscle the ChE present is mostly of the specific type and is located at the motor end plate. That it is firmly attached to this structure is shown by the fact that even after muscle has been washed repeatedly in saline solution, much ChE activity remains. Moreover it is present in great concentration at this site; particularly in the subneural apparatus.

These facts permit further simplification of the technic. Because only one type of ChE is present in measurable amount, it is necessary to test with only one substrate. Localization of specific ChE is favored over that of nonspecific ChE by maintenance of the substrate concentration ( $4 \times 10^{-3}$  M) in the optimal range for the specific type. Also, because there is a concentration of enzyme at the motor end plate, a mass of CuS is normally deposited at this site (fig. 1). Consequently it is easier to distinguish between the normal amount and any reduction in intensity or area of the deposit. A reduced amount of CuS is a consequence of partial inhibition of enzymatic activity (fig. 2) and absence of deposit, of complete inhibition (fig. 3). Thus the technic can be used for a quasi-quantitative estimate of ChE activity or inhibition at the motor end plates.

percent of local anterior deviations (Class I) and normal molar relationships indicate etiologic localized and genetic factors, respectively. Although a large percent of the modern Eskimos possess well-developed jaws and arches in proper mesiodistal relationship, they have a high incidence of caries. There appears to be no correlation between caries resistance, jaw growth and development, and arch relationship in these Eskimos.

Mouth breathing is prevalent among Eskimos (11). The hypothesis, cited by some orthodontists, that mouth breathing causes narrow arches and Class II, Division I malocclusions, is untenable in respect to these mouth-breathing natives with broad-arched palates.

Comparisons of the teeth in primitive Eskimo skulls and modern Eskimos over 35 years of age show a similar pattern of attrition of the occlusal molar surfaces due to the rugged character of their diet. The occlusal surface slopes down from the higher buccal to the lower lingual cusp on the upper molars, while the lower buccal cusps slope up to the higher lingual cusps on the lower molars. As a result, abnormal forces of mastication are set up during excursions, causing resorption of the lingual alveolar process and gingiva on the upper molars with a concurrent loss of alveolar and gingival structures on the buccal surfaces of the lower molars. The resulting periodontal traumatism not only causes periodontal pockets, but apparently affects the temporomandibular joint, as well.

A study of the temporomandibular articulation of primitive Eskimo skulls reveals resorption of the articular eminence, a reduction of the angle of the articular eminence, and flattened articular surfaces of the condylar head due to resorption. Riesner (12) has shown the relationship of edge-to-edge bites to the temporomandibular joint. The coarse consistency of the Eskimo diet may have acted as an orthodontic appliance by obliterating the inclined planes of the occlusal surfaces, thereby transmitting excessive stress during lateral mastication to the temporomandibular joint, resulting in an alteration of these extra-alveolar bony contours and finally causing an edge-to-edge bite.

#### GENETIC FACTORS

Brash (13) revealed the role of genetics in jaw form when he stated: "Such evidence as we have of the inheritance of face and jaw form all points to the genetic condition as a pri-

(11) Footnote reference (10), p. 423.

(12) Riesner, S. E.: Temporomandibular resorptions in occlusal anomalies. *J. Am. Dent. A.* 23: 1938-1939, Dec. 1938.

(13) Brash, J. C.: The Aetiology of Irregularity and Malocclusion of the Teeth. *Dental Board of the United Kingdom*, London, 1929, pp. 191-246.

mary factor." Krogman (14) analyzed "race-mixture data and found that face height and hyzygomatic breadth were phenotypically dominant although modifiable, and that in a Mongoloid-Caucasoid cross hizygomatic breadth was dominant over height. Greater mandibular (gonial) breadth is dominant as is also progenia." The predominance of normal and Class 1 occlusions in the modern Eskimo dentition compares favorably with the primitive, indicating a hereditary dominance.

The controversial problem of whether the broad U-shaped arches of the Eskimo are the result of increased function or due to hereditary influences is frequently encountered during the study of the dentofacial complexes of these people.

Waugh (15) stated, "...we have come to believe that the size of the body of the jaw is determined largely by heredity and form; quantity and size of the alveolus are primarily the result of function." The transverse diameter of the palate is attained for the most part by growth in the median palatine suture. Watt and Williams (16) stated that "the mastication of foods that require vigorous function is likely an important stimulus in the growth in width of the maxilla in young animals, but in adult animals (rats), after the growth sutures have fused, further increase in width is impossible." The transverse palatal diameters of the adult Eskimos I examined showed variable thickened alveolar processes, particularly in the molar area, as compared with those of the children. I concluded that because an adult had used his teeth for a longer time, his alveoli had adapted to the functional stress by the apposition of supporting bone.

Because the width of the transverse palatal arch would be a variable measurement depending on the physical consistency, musculature, et cetera, I decided to delineate the genetic factor by measuring the palatal arch widths with a Boley gage as follows:

*Intermolar width.* The width of the palate was measured posteriorly between points on the buccal surfaces of the first molars. These points were taken between the middle and distobuccal cusps.

The *intercanine width* was taken between the maxillary canines at the height of greatest curvature on the labial surfaces at about the midpoint of the mesiodistal diameter.

(14) Krogman, W. M.: Inheritance of non-pathologic physical traits in man. Eugenical News 21: 139-146, Nov.-Dec. 1936.

(15) Waugh, L. M.: Influence of diet on jaws and face of American Eskimo. J. Am. Dent. A. 24: 1640-1647, Oct. 1937.

(16) Watt, O. G., and Williams, C. H. M.: Effects of physical consistency of food on growth and development of mandible and maxilla of rat. Am. J. Orthodontics 37: 895-928. Dec. 1951.

TABLE 3. Masticatory arch widths

	Number	Internasal			Intercanine		
		Mean (mm.)	Range (mm.)	Standard deviation (mm.)	Mean (mm.)	Range (mm.)	Standard deviation (mm.)
Modern Eskimo boys (Age 8-12 years)	14	56.4	52-60	±1.53	38.9	34-41	±1.67
Modern Eskimo girls (Age 8-12 years)	16	55.7	52-62	±2.66	38.6	34-41	±2.15
Modern male adult Eskimo	27	60.6	57-64	±1.84	41.1	35-47	±2.17
Modern female adult Eskimo	27	58.2	54-64	±2.14	39.9	35-42	±2.004
Primitive male adult Eskimo skulls	13	61.4	56-64	±2.53	40.0	36-43	±2.15
Primitive female adult Eskimo skulls	13	57.6	54-62	±2.30	38.7	32-42	±2.79

*Analysis.* The maxillary intermolar and intercanine arch widths are shown in table 3. The palatal arch widths of the male (primitive and modern) are larger than those of the female. Furthermore, the similarity of measurements (mean, range, and standard deviation) indicate an inherent genetic pattern between primitive and modern Eskimos insofar as palatal arch width is concerned.

Measurements of the palatal arch widths of Eskimo children between the ages of 8 and 12 years showed that 93.1 percent of the mean adult male intermolar arch width was attained in boys and 95.7 percent was attained in girls; 96.8 percent of the mean adult intercanine arch width was attained in boys and 96.7 percent was attained in girls.

The fact that the modern Eskimo's diet has been altered in comparison with the primitive Eskimo does not seem to have affected the intercanine and intermolar arch widths, but the transverse palatal dimension between the 2 bucco-alveolar processes may be affected in proportion to the masticatory forces. This is merely another corroboration of the plasticity of bone in responding to functional stress. Furthermore, on the basis of the similarity of palatal arch widths and the prevalence of normal occlusions, it can be stated that despite the intermixture of white racial strains, the normal, molar mesiodistal relationships, and the broad, well-developed arches of the natives are genetically dominant.

### CONCLUSIONS

The diet of the primitive Eskimo contained all the vitamins and minerals essential for normal dental health. That of the modern Eskimo includes a greater proportion of carbohydrate foods. Primitive Eskimos had practically no caries, but dental decay is becoming increasingly prevalent among the modern Eskimos. A greater percent of malocclusion was observed among modern as compared with primitive Eskimos. Most of the adults observed had normal occlusions. Most malocclusions were Class I; none were Class II; and a small percent were Class III. The tendency toward inheritance of normal occlusion among the Eskimos appears to be greater than that toward inheritance of abnormal occlusion although variations were observed. Edge-to-edge bites were prevalent among adults, while children under 14 years of age showed overbites and overjets. Edge-to-edge bites could be considered the result of the astringent quality of the diet.

The altered diet of modern Eskimos seems to be a factor in the increase of malocclusions as compared with primitive Eskimos. The greater percent of local anterior deviations (Class I)

and normal molar mesiodistal relationships indicate localized etiologic and genetic factors respectively. There appears to be no correlation between caries resistance and jaw growth and development, or between caries resistance and arch relationships in the Eskimos.

The opinion that mouth breathing is an etiologic factor in narrow arches and Class II malocclusions is untenable among the mouth-breathing Eskimos with broad-arched palates. The physical consistency of the Eskimo diet has caused attrition of the occlusal surfaces of the teeth, periodontal traumatism, and seems to have caused an alteration in the bony contours of their temporomandibular joints.

As far as the molar mesiodistal relationship (occlusion) and palatal arch widths and contours are concerned, there has not been sufficient intermixture of white racial strains nor change in the type of diet to suppress the previously mentioned dominant hereditary factors in the Eskimos which have been stabilized through centuries of natural selection and inbreeding.

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#### BOOK REVIEW

*Clinical Progress in Cardiovascular Disease*, edited by Herman L. Blumgart, M. D., Physician-in-Chief, Beth Israel Hospital, and Professor of Medicine, Harvard Medical School, Boston, Mass. Modern Medical Monographs, No. 2. 143 pages; illustrated. Grune & Stratton, Inc., New York, N. Y., publishers, 1952. Price \$4.50.

Since December 1950 Circulation has published authoritative critical reviews on recent advances in cardiovascular disease. This small book contains all the reviews published from December 1950 through July 1952. A wide variety of subjects has been selected. The editors of Circulation are to be commended for their choice of subjects and authors. Most of the essays are devoted to the clinical aspects of cardiovascular disease. They are authoritative, brief but to the point, and complete. An adequate bibliography is included with each essay. This small volume is heartily recommended, particularly to those who do not have ready access to the original articles.

—Col. E. M. Goyette, MC, U. S. A.

# ANALYSIS OF CESAREAN SECTIONS<sup>(1)</sup>

L. MARSHALL HARRIS, *Captain, MC, U. S. N.*

JAMES M. JONES, *Lieutenant, MC, U. S. N.*

**T**HE following observations relating to indications for, incidence of, and statistics on cesarean sections were made after reviewing the records of the obstetric and gynecology services at this hospital for the period of 1 July 1950 to 1 July 1951. The source of clinical material is varied in that many of our patients were referred or transferred from different parts of the country and from abroad, and it is controlled in that only dependents of active duty Navy and Marine Corps personnel were eligible for treatment. Antenatal care is somewhat standardized and is given in the clinic either at the Naval Dispensary in Washington, D. C., or at this hospital, both under the cognizance of the chief of the obstetrical service at the hospital. All antenatal patients are sent to the hospital for delivery and postpartum treatment and all patients who present obstetrical difficulty are referred to the hospital for consultation and for admission as indicated.

There were 1,961 deliveries on the service in the stated period with 46 cesarean sections, or an incidence for the period of 2.3 percent. The current annual number of deliveries would be much higher with a monthly average of about 225 deliveries. The current cesarean section rate is 4.8 percent, figured on the basis of the 3 months ending 29 February 1952. The average rate for 10 of the larger civilian hospitals is about 4.9 percent. All patients are delivered by an obstetrical resident and with consultation, evaluation, and disposition as to type of treatment and/or delivery by the chief of service.

The trend toward liberalization in the indication for abdominal delivery (reflected in the above figures) has been influenced by more adequate evaluation, better-trained obstetricians, and the advent during the past few years of the blood bank, antibiotics, chemotherapy, and improved hospital facilities. We are basically in accord with this liberalization but each patient must be considered individually. Our present policy does not necessarily mean adherence to the dictum "once a cesarean section, always a cesarean," but consideration of the source of our patients, the existing low morbidity and mortality rates, and improved facilities seems to justify such practice in most cases.

<sup>(1)</sup> U. S. Naval Hospital, National Naval Medical Center, Bethesda, Md.

Table 1 shows the age incidence of the patients who were delivered by cesarean section. Table 2 shows their parity. This indication was disregarded in 25 patients who had had previous section. A low cervical operation was performed on 40 patients. The classical operation was performed on 6 patients in whom sterilization was to be accomplished or in whom marked varicosities, adhesions, or tumors in the lower uterine segment made this the operation of choice. The low lying placenta has not been accepted in this hospital as an absolute indication for the classical operation. In 6 patients with placenta praevia who had moderate to marked blood loss the pregnancy was terminated by cesarean section in only 2. In all patients with placenta praevia it is routine to prepare for cesarean section by arranging for blood for transfusion and examining the patient in the operating room under "double setup" in which a sterile vaginal examination is performed and, if section is found to be indicated, the abdomen can be prepared without removing the patient from the table. Whether the transverse or the longitudinal incision was used was largely left to the physician's preference, but such factors as varicosities and rotation of the uterus influenced his choice in some cases.

TABLE 1. Age of 46 patients delivered by cesarean section

Age (years)	Number
18-19	1
20-29	25
30-39	17
40 or over	3

TABLE 2. Parity of 46 patients delivered by cesarean section

Para	Number
0	12
1	19
2	12
4 or more	1

The indications are shown in table 3. In some patients there was more than one indication. Cephalopelvic disproportion was determined by trial of labor and roentgenographic pelvimetry. Uterine inertia is often seized on by the impatient and uninformed as an indication for cesarean section in that relatively rare patient, who, for one reason or another, fails to meet our expectations in so far as the progress of labor is concerned. In 2 of our 3 patients with uterine inertia, the ineffective uterine contractions persisted in spite of the use of analgesics, rest, parenteral fluids, and oxytocics. After 30 or more hours of desultory labor with no progress the patients became exhausted and an elective low cervical section with antibiotics and transfusion of whole blood was accomplished. These patients were primigravidae. There was no evidence of the so-called Bandy's ring and with alphahypophamine given by intravenous drip there was no postpartum hemorrhage. In 1 of these patients irregularity of the fetal heart influenced the decision to intervene, but in both cases viable infants were delivered.

ed. The third patient had ineffective uterine contractions in the presence of uterine fibrinids and elective section was accomplished after 36 hours with poor progress, moderate uterine bleeding, and evidence of fetal distress.

TABLE 3. *Indications for cesarean section*

Indication	Number
Previous section	25
Cephalopelvic disproportion	10
Abruption placentae	5
Uterine inertia	3
Toxemia	3
Placenta praevia	2
Previous vaginal plastic surgery	2
Diabetes	2
Elderly primigravida	1

The diagnosis of abruptio placentae was made early from the history of sudden pain and tetanic contractions (with external bleeding in 3 of the 5 patients and without external bleeding in 2). The signs and symptoms presented on admission were diagnostic and in 3 patients the cervix on examination under double setup was found to be long, firm, and undilated and the fetal heart sounds were inaudible. Pain increased with increase of tetanic contractions and enlargement of the uterus. The condition of the mother became poor and an elective section was performed. In 2 deliveries a nonviable fetus was obtained and in 3 the fetus required prolonged resuscitation but survived. In 2 patients the shuttle gauze method (gauze was forced down into the vagina from above) was resorted to in addition to continuous alphapropophamine given by intravenous drip and in 3 oxytocics alone were used. None of the patients had postpartum hemorrhage.

The patient who was classified as an elderly primigravida was 43 years of age and very anxious for a baby. She had a borderline contraction of the pelvis and an elective cesarean section was performed. The patients with toxemia of pregnancy were sectioned in the interest of both mother and fetus after conservative efforts failed to bring the toxemia under control in the presence of an undilated, unripe cervix from 1 to 6 weeks from term. The patients were definitely pre-eclamptic, failed to respond to treatment after adequate therapy, and presented a problem as to fetal survival. Two of the infants died following delivery. One death was attributed to abruptio placentae and prematurity associated with toxemia.

The diabetic patients were controlled medically up to the thirty-seventh and thirty-eighth weeks, respectively. Because of roentgenographic evidence of excessively large fetuses, a history of the loss of 2 and 3 babies, respectively, and the relative fetopelvic disproportion abdominal delivery was accomplished. Both infants survived.

In this series spinal anesthesia was used on 39 patients, procaine locally supplemented by pentothal in 3, cyclopropane in 3, and ether in 1.

A member of the anesthesia staff is on call at all times so that the obstetrician may have the agent of choice with the guidance, experience, and co-operation of the anesthetist. There were complications in 4 patients. One developed thrombophlebitis, one a superficial infection in the incision, one an unexplained rise in temperature above 100.4° F. on 2 occasions, and one 48 hours prior to cesarean section had rupture of the membranes with a discharge of purulent amniotic fluid. None of the mothers in this series died but there were 5 fetal deaths. One was delivered 16 days after the expected date of confinement. The mother had had a previous cesarean section. She was delivered under cyclopropane anesthesia of an infant weighing 4 lb. 11 oz. who died 2 days later. Autopsy revealed cerebral hemorrhage, pulmonary atelectasis, and prematurity. The second was delivered 14 days after the expected date of confinement. The mother had uterine inertia and spinal anesthesia was used. The baby weighed 7 lb. 2 oz. at birth and died in the first day of congenital pulmonary atelectasis. The third was delivered under cyclopropane anesthesia to a mother who had had a previous cesarean section. The infant was anencephalic. The fourth was delivered under spinal anesthesia to a mother who had eclampsia and abruptio placentae. The infant weighed 2 lb. 14 oz. and autopsy revealed prematurity and intraventricular hemorrhage. The fifth was delivered under ether anesthesia to a mother who had abruptio placentae. The infant weighed 6 lb. and was stillborn.

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# PRIMARY HYPERLIPIDEMIA

I. LOUIS HOFFMAN, *Colonel, U. S. A. F. (MC)* (1)

RICHARD R. GRAYSON, *Captain, U. S. A. F. (MC)* (1)

**P**RIMARY hyperlipidemia is a relatively rare disease. Only 19 cases have been reported in the literature. The first case of primary hyperlipidemia was reported by Bürger and Grütz (2). Movitt et al. (3) tabulated a total of 14 cases and added 3 cases of their own. Case reports of only 2 other patients with this disorder have been published to our knowledge. One was reported by Koszalka and Levin (4) and the other by Dunphy (5). In this condition an excessive amount of fat or lipids are found in the serum and it is recognized by the milky, opaque appearance of the serum (4). Movitt et al. (3) stated that primary hyperlipidemia is a disorder of fat metabolism characterized by hyperlipidemia of the retention type, frequently accompanied by hepatosplenomegaly, eruptive xanthomatosis, and abdominal pain or discomfort. Thannhauser (6) reported that the milky appearance of the serum is usually due to an increase in the neutral fat content above 150 percent of the normal value. He also found that an increase of cholesterol or phospholipids without an increase of the neutral fat never causes a milky serum (7). Ahrens and Kunkel (8) pointed out that if the amount of phospholipid in plasma is 30 percent or more of the total lipids, the plasma will be clear and appear nonlipemic even at total lipid levels as high as 3,000 mg. per 100 cc.; but if it is less than 30 percent, the plasma will be cloudy and appear

(1) Reese Air Force Base, Tex., at time of writing.

(2) Bürger, M., and Grütz, R.: Über hepatosplenomegale Lipoidose xanthomatosen Veränderungen im Haut und Schleimbaut. Arch. f. Dermat. u. Syph. 166: 542-575, Oct. 1932.

(3) Movitt, E. R.; Gerstl, B.; Sherwood, F.; and Epstein, C. C.: Essential hyperlipidemia. Arch. Int. Med. 87: 79-96, Jan. 1951.

(4) Koszalka, M. F., and Levin, J. J.: Idiopathic hyperlipidemia. Ann. Int. Med. 33: 473-480, Aug. 1950.

(5) Dunphy, E. B.: Ocular conditions associated with idiopathic hyperlipidemia. Am. J. Ophthalm. 33: 1579-1586, Oct. 1950.

(6) Thannhauser, S. J.: Lipidoses: diseases of cellular lipid metabolism. In Christian, H. A.: Oxford Medicine. Oxford University Press, New York, N. Y., 1949. Vol. 4, Pt. 2, p. 595.

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(8) Ahrens, E. H., and Kunkel, H. G.: Stabilization of serum lipid emulsions by serum phospholipids. J. Exper. Med. 90: 409-424, Nov. 1949.

TABLE I. Blood lipid studies (in mg. per 100 cc.)

	Normal	On admission (9 Feb.)	Before low-fat diet (19 Apr.)	After low-fat diet (26 Apr.)	After thyroid therapy (2 May)	On ordinary diet (3 Oct.)
Total lipid*	450-650	4,020.0	1,320.0	800.0	1,110.0	3,300
Fatty acids	310-460	3,597.6	1,093.0	617.2	927.0	2,997
Lipid phosphorus	10-14	21.9	~	7.7	2.2	9.76
Total cholesterol	150-250	248.8	226.2	182.8	185.0	303
Cholestanol esters	80-180	38.2	100	71.8	61.9	65.1
Lecithin	78	—	452.5	—	—	—

albumin, 53 percent; alpha 1 globulin, 3 percent; alpha 2 globulin, 10 percent; beta globulin, 13 percent; gamma globulin, 21 percent; A/G ratio, 1.1; and total proteins, 7.56 grams per 100 cc.

Because of the unpublished observations of Harvill, adenosine-5-monophosphate was administered to determine whether it would lower the blood cholesterol level. Beginning on 2 August, 1 cc. of this drug was injected intramuscularly every 2 days for 3 doses. On 7 September this was repeated.



Figure 1.

Before administration of adenosine-5-monophosphate in August there were 2,624 mg. of cholesterol per 100 cc. of mixed blood serum (209 in the clear portion of the serum) and after administration of the drug there were 740 mg. of cholesterol per 100 cc. of mixed blood serum (175 in the clear portion). In September there were 478 mg. of cholesterol per 100 cc. of serum before administration of the drug and 374 after.

On admission the erythrocyte count was 5,430,000 with 15.85 grams of hemoglobin. The leukocyte count was 8,500 with 68 percent neutrophils, 26 percent lymphocytes, and 6 percent monocytes. Subsequent blood counts showed no essential change. The platelet count was 300,000. The bleeding time was 1 minute. The blood coagulation time was 6½ minutes.

The nonprotein nitrogen was 47; serum lipase, 0.3 cc.; alkaline phosphatase, 3.34 Bodansky units; acid phosphatase, 2.32 Bodansky units; serum phosphorus, 5.6 mg. per 100 cc.; and serum amylase, 8 units. The total protein on admission was 9.6 grams per 100 cc. The A/G ratio was reversed at this time; albumin, 3.5 grams per 100 cc. and globulin, 6.1 grams per 100 cc. Serial blood protein studies during convalescence from the infected vaccination showed reversion to normal values 3 weeks after admission. Five minutes after injection of bromsulphalein, 82 percent was still present in the blood and at the end of 30 minutes, 4.5 percent was present. The prothrombin

time was 100 percent. Four hours after the oral administration of 6 grams of sodium benzoate, a total of 3.9 grams of hippuric acid was recovered from the urine.

### COMMENT

This patient has been followed for 6 months since his hyperlipemia was discovered. There has been no change in the milky appearance of blood serum in that time. The only factor which decreases the amount of fat in his blood is a low-fat diet. This is in accordance with the experience of other authors. The cholesterol level in mixed serum is much higher than that in clear serum. The significance of the low percentage of esters as compared to total cholesterol is unknown. In this patient, the total cholesterol level was not much above normal when the clear portion of the blood serum was analyzed. When the mixed milky serum was analyzed, there was a marked increase in the cholesterol level. The only known treatment of this condition is a low-fat diet. The prognosis is considered to be good and premature arteriosclerosis probably does not develop in these patients (12). When last seen this patient was performing his military duties in a satisfactory manner.

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### BOOK REVIEW

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*Practical Pharmacology*, by J. H. Burn, Professor of Pharmacology, University of Oxford, Illustrations by E. M. Vaughan Williams. 72 pages; illustrated. Blackwell Scientific Publications, Oxford, England, publisher, 1952. Published simultaneously in the United States by Charles C Thomas, Publisher, Springfield, Ill., 1952. Price \$3.25.

This book presents 21 groups of experiments, designed to be performed before a class, and represents the work of several people who have had a share in developing the present course in practical pharmacology offered at the University of Oxford. The work is presented in a clear, easily assimilated form and the illustrations are well prepared and helpful. It is interesting and useful as a reference book and is fairly comprehensive, but its value as a text in the United States would be doubtful, because some of the methods described are not used in this country.

—Commander R. L. Taylor, MSC, U. S. N.

# SYPHILITIC ANEURYSM OF THIRD PORTION OF THE SUBCLAVIAN ARTERY

EUGENE D. ERMAN, Major, MC, U. S. A. (1)

**R**EPORTS of the successful removal of a syphilitic aneurysm of the third part of the subclavian artery and the first and second parts of the axillary artery are rare. The threat of rupture and fatal hemorrhage is a specific indication for resection of such lesions when accessible. Daniel (2) recently reported the successful removal of 2 syphilitic aneurysms, both of the first portion of the subclavian artery. He stressed the facility with which these tumors were removed by opening the pleural cavity. Temple (3) also entered a plea for the transpleural exposure in approaching the first part of the subclavian artery. He described the collateral circulation after ligation of the first part of the subclavian artery on the left side.

## CASE REPORT

A 52-year-old Negro was admitted to this hospital on 30 July 1951 complaining of swelling in the left supraclavicular area of 2 weeks' duration. When first noted, the swelling was the size of a small plum. It was associated with minimal pain. The patient had no knowledge that he had syphilis.

His eyegrounds showed slight tortuosity of the vessels and arteriovenous nicking in a ratio of 1:2. The left side of his neck contained a fullness which on admission measured 2 cm. in elevation by 2 by 4 cm. (fig. 1). The mass was bounded anteriorly by the clavicle, medially by sternocleidomastoid muscle, and laterally it disappeared gradually under the deltoid muscle. The veins of his neck on the left side were markedly distended and the mass pulsated synchronously with the heart beat and the radial pulse. There was no edema of either arm or hand. The blood pressure in his right antecubital fossa was 215/140 and in his left, 180/140. The peripheral arteries pulsated normally except for his left radial artery which pulsated much more weakly than his right but was palpable. Moderate perspira-

(1) Gorgas Hospital, Ancon, C. Z.

(2) Daniel, R. A., Jr.: Syphilitic aneurysm of subclavian artery. Ann. Surg. 134: 251-258, Aug. 1951.

(3) Temple, L. J.: Aneurysm of first part of left subclavian artery; review of literature and case history. J. Thoracic Surg. 19: 412-421, Mar. 1950.

An umbilical tape was slipped around the artery and left in place while further dissection of the aneurysm was performed. The umbilical tape was then tied, thereby stopping the arterial supply and pulsation of the aneurysm. Two No. 00 black silk ligatures, one a transfixion suture, were placed distally and the artery was cut. The axillary artery was tied doubly with No. 00 silk, transfixed in its third portion, and cut. The aneurysm was freed from its adjacent structures, including the anterior, lateral, and posterior cords of the brachial plexus and the subscapularis muscle. The subscapular artery was found to leave the posterolateral surface of the aneurysm and it was doubly ligated with No. 00 silk and cut. No other arteries leading from the aneurysm were found. The wound was closed in layers. Drainage of the subcutaneous space was accomplished with a split Penrose rubber drain.



Figure 3. Anterior surface of aneurysm with sac opened.

Gross examination after operation revealed an aneurysmal dilatation of the last part of the subclavian artery and the first and second parts of the axillary artery which measured  $4\frac{1}{2}$  by  $4\frac{1}{2}$  by 5 cm. The bulk of the aneurysm protruded supenorly. The wall of the aneurysm was 3 mm. thick and was partially filled by a laminated clot which was 1 cm. thick. Several small patches of stellate wrinkling were seen on the intimal surface of the artery in the aneurysm. A 6-cm. length of the accompanying vein was attached to the anterior surface of the artery (fig. 3).

Microscopic sections revealed extensive obliterative endarteritis of the vasa vasorum with dense, perivascular collections of plasma cells and lymphocytes. The intima was moderately thickened. In some areas, however, the endothelial lining was absent, the intima was thin, and the laminated clot was adherent to the free surface. The elastic fibers of the media were fragmented. A pathologic diagnosis of syphilitic aneurysm was made.

The patient was afebrile after the third day. There was no postoperative swelling of his left arm. His left radial pulse

was not palpable after the operation but his left hand and arm were only slightly less warm than his right. His blood pressure could not be obtained in the left arm after the operation and in the right arm was unchanged. On the seventh postoperative day his skin sutures were removed and the wound was well healed. Physiotherapy was started and the range of motion of



Figure 4. Postoperative venogram showing collateral venous return after ligation of cephalic and axillary veins.

his left arm gradually increased. Within 12 days after operation he had regained complete function. Thirteen days postoperatively a subcutaneous pocket of 50 cc. of sterile serum was aspirated from the lateral border of the incision. Several aspirations were performed during the next few days for the removal of small amounts of serum. Eighteen days after operation no further aspirations were necessary.

One month after operation a venogram of the left shoulder girdle revealed the channels through which the venous blood returned from the arm to the shoulder girdle and chest wall (fig. 4). It is believed that the collateral arterial supply to the arm accompanies the demonstrated venous return. Two months after operation there was no edema of the left hand or arm. Slight venous distention was noted over the arm and shoulder. The left radial artery was not palpable and the blood pressure

was not obtainable. In spite of the absent pulse and blood pressure, function of the left upper extremity was normal and the skin was only slightly less warm than that of the right. Six months after surgery no change was noted in the patient's condition.

### DISCUSSION

Unilateral clubbing of the fingers has been reported previously (2, 4). Although the clubbing was not marked in this patient, it was definitely present. Of special interest in this patient is the unusual preoperative arteriogram which accurately delimited the medial border of the lesion and made preoperative planning of the approach a relatively simple matter. Because the arteriogram showed no involvement of the first part of the subclavian artery, the approach to this tumor was extra-pleural. Resection of the clavicle gave adequate exposure. The aneurysm of the subclavian artery was situated lateral to the origin of both the thyrocervical axis and the internal mammary arteries and it lay medial to the anterior and posterior circumflex branches of the axillary artery. Collateral circulation was adequate from the moment of ligation. Undoubtedly, the laminated intramural clot had caused collateral arterial channels to become well established during the progression of growth of the aneurysm.

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(4) Brooks, B.: Aneurysm of axillary artery; case of spontaneous aneurysm of first portion of axillary artery associated with unilateral clubbing of fingers and Dupuytren's contracture. *S. Clin. North America* 10: 741-755, Aug. 1930.

### BOOK REVIEW

The 1951 Year Book of Endocrinology (January 1951-January 1952), Edited by Gilbert S. Gordon, M. D., Ph. D., Assistant Professor of Medicine, University of California School of Medicine, Assistant Physician, University of California Hospital; Consultant Endocrinologist, Langley Porter Clinic at the State Department of Mental Hygiene, San Francisco, Calif. 415 pages, illustrated. The Year Book Publishers, Inc., Chicago, Ill., 1952. Price \$5.

This book admirably covers the rapid advances made in clinical endocrinology. The current literature has been expertly summarized, and is all the more valuable because of the many pertinent, authoritative editorial comments. Such a year book is especially useful to the busy physician who does not have ready access to the original publications.—*Col. R. E. Blount, MC, U. S. A.*

# METHOD OF DETERMINING INTRAMEDULLARY NAIL SIZE AND LENGTH

AUGUST W. SPITTLER, *Colonel, MC, U. S. A. (1)*

JOHN J. BRENNAN, *Lieutenant Colonel, MC, U. S. A. (1)*

**F**IXATION of a femoral fracture with an intramedullary nail necessitates a simple method of determining accurately before operation the exact length and medullary canal dimensions of the femur. A simple device to facilitate accurate measurement of femoral length and canal width is herein presented. This has been successfully employed at this hospital for 2 years.

The first method to be used for determining exact bone measurements was that introduced by Millwee (2). This was called "slit scanography." In this method a roentgenographic table with a side nail and arm is used. The arm holds the roentgen tube at a set target distance and the tube is propelled lengthwise in relation to the table at set speeds by a motor-driven gear. An adjustable slit cone is used between the tube and the patient. This reduces the effect of distortion and variation of density. Direct measurement on the developed film determines bone length.

Mueller and Higgason (3) reported the "spot scanography" method of determining bone length. The patient is placed on a roentgenographic table in a supine position with a 14- by 17-inch film under the thigh. A roentgen tube, with a small circular cone, is centered directly over the proximal end for one exposure and over the distal end of the femur for a second exposure. The patient is not moved between exposures. From the roentgenogram, a direct measurement of the femoral length is possible.

Bell and Thompson (4) reported a "modified spot scanography" method in which a steel rule 1/64-inch thick is placed on the

(1) Walter Reed Army Hospital, Washington, D. C.

(2) Millwee, R. H.: Slit scanography. *Radiology* 28: 483-486, Apr. 1937.

(3) Mueller, W. K., and Higgason, J. M.: Spot scanography; method of determining bone measurement. *Am. J. Roentgenol.* 61: 402-403, 1949.

(4) Bell, J. S., and Thompson, T. A. L.: Modified spot scanography. *Am. J. Roentgenol.* 63: 915-916, June 1950.

center line of the roentgen table. The part to be exposed is centered to the steel rule and the cassette is covered with a sheet of lead having 2 holes, each 4 inches in diameter, which can be closed. These are centered also for upper and lower ends of the femur. From 2 exposures any 2 points at opposite bone ends can be readily calculated from the reading of the ruler on the film.

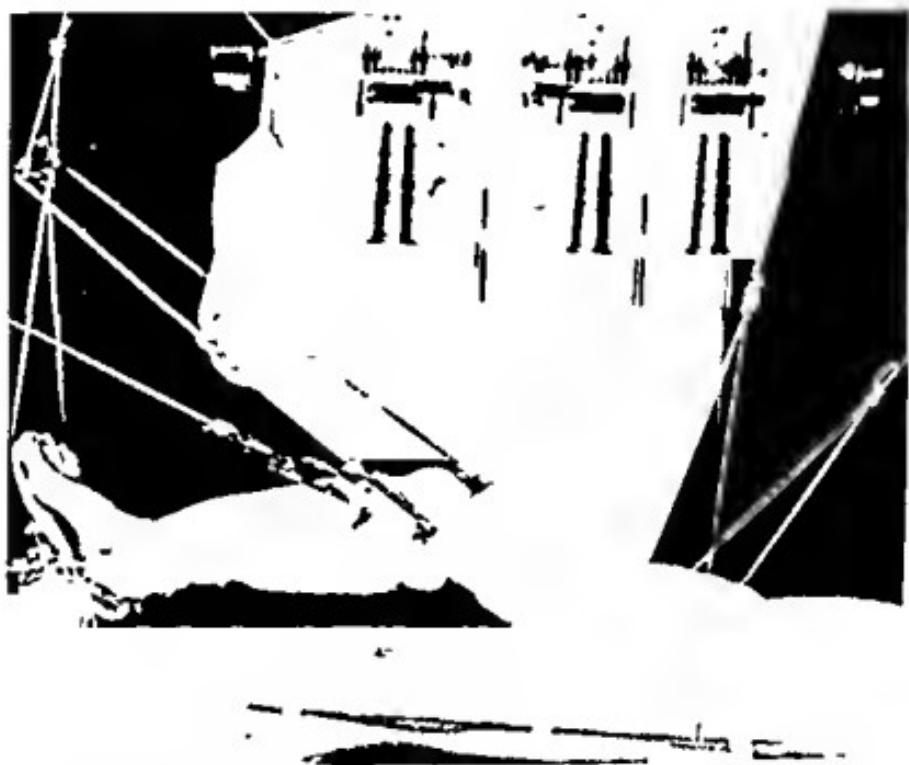


Figure 1.

Lottes (5) reported a method to be used at the patient's bedside. Two 10- by 12-inch cassettes and 2 medium Kirschner wires are used. One cassette is placed under the hip with the Kirschner wire under the greater trochanter and at a right angle to the long axis of the femur. The second cassette is placed below the first with the second wire parallel to the first and beneath the knee. The distance between wires is placed deliberately at 15 inches. One exposure is made over the trochanter and another over the knee joint. The length of the femur can be determined from the films by direct measurement of the distance of the upper wire from the tip of the trochanter and the distance of the lower wire from the knee joint. A direct measurement of the medullary canal on the film is used for the canal width.

(5) Lottes, J. O.: Treatment of fractures of femur with heavy, large cored, three-ganged medullary nail. *Surgery* 29: 568-584, June 1951.



Figure 2.

#### METHOD

Our method uses the principle of Bell and Thompson (4) with some simplification. Like the method employed by Lottes (5), the patient does not have to be moved to the roentgen table. In spite of this, it has proved to be very accurate. A metal rod with saw-cut markings at intervals of 1 cm. is used. Our rod is of ordinary bar stock aluminum found in most brace shops. Additional radiopaque markings made by wrapping wire about the rod at intervals of 40 cm. speed the calculations.



Figure 3.

The marked metal rod is affixed to the lateral side of the uninjured extremity with adhesivo tape. It is placed at the level of the bone to help rule out projection differences. One of the wire markers is located at the level of the upper trochanter as determined by palpation. Roentgenograms are made with a portable x-ray machine (1) over the patella, (2) over the junction



Figure 4.

of the upper and the middle third of the femur, and (3) over the trochanter (fig. 1). On the roentgenogram, the rotation of the wire on the metal rod above or below the trochanter (fig. 2) or condyles (fig. 3) is determined at a glance. The centimeter markings are easily read and the distance between wires, being 40 cm., enables one to calculate rapidly and accurately the length of the femur. The third film (fig. 4) is used to calculate the medullary canal width. A centimeter ruler is used to measure the narrowest portion of the femoral canal on the developed film and the length of the centimeter marking of the metal rod at the same level. The true width, ruling out projection differences, is calculated as follows.

If 1 cm. on the rod measures 1.2 cm. on the film, and the width of the canal measures 11 cm. on the film,  $1.2/1 = 11/x$  where  $x$  is the true width, and  $x = 9.16$  cm., the true canal width. This method is accurate and is simpler than others that have been advocated. It is not time-consuming and does not disturb the patient's fractured extremity by unnecessary movement. By its use we have been able to use intramedullary nails of exact length and have avoided, in many cases, the complications of painful pin hursas.

# THE FORGOTTEN CALF

A Clinical Comment

WALTER R. MILLER, *Commander, MC, U. S. N. (I)*

**T**HE title of this article was not prompted by a sense of facetiousness but rather by the idea of attracting attention to a badly overlooked subject. Rehabilitation of the musculoskeletal system following injuries has been emphasized since World War I and has been given great impetus during and since World War II. Orthopedists and general medical officers of all services have been made aware of the necessity for restoring the power of the quadriceps group of thigh muscles to near normal strength in the rehabilitation of injuries to the lower extremities. Great credit is due Thomas L. deLorme for his splendid work in developing passive resistive exercise to fit the particular needs of people with injuries to their extremities.

All persons engaged in the rehabilitation of patients with injuries to the lower extremities have been impressed with the fact that those with even severe injuries to the ligaments of the knee and residual relaxation and abnormal mobility in that joint can, if they have the will to do so, so develop the quadriceps group of muscles that their gait becomes almost completely normal. The knees of these patients become asymptomatic under even the conditions of military service.

For some strange reason it is common to see patients, who have bad injuries to the leg, particularly in the lower half of the leg, and whose leg has been long encased in a cast, walk about the hospital and even returned to duty with an obvious flatfoot gait resulting in a limp and a list to the injured side with each step all because of failure to rehabilitate the posterior leg muscles which provide the strong, resilient plantar flexion of the foot and an adequate springy "take-off" with each step. Apparently it is easy to forget that when the ankle is immobilized in plaster, the muscles causing normal plantar flexion of the foot at the tibiotalar joint are not being used and therefore undergo rapid atrophy and diminution in size and power just as does the quadriceps group in the thigh when it is not being used. Furthermore, it also seems easy to forget that with fractures involving the leg, muscles of both the anterior and posterior compartment may become bound down in

(1) U. S. Naval Hospital, Portsmouth, Va.

off-duty hours. This method released the professional officers of the day from a restricting duty, which often would otherwise have prevented their attendance on seriously ill patients elsewhere in the hospital. Also, 1 medical officer could not give adequate attention to the acutely ill patients of the convoy, review their battle tags, and write an intelligent admission note on 40 or even 20 patients. The time factor was important in that an experienced team of 4 medical officers could review a convoy in about 2 hours. During that period each patient was carefully examined, his dressings changed, and his records reviewed. Patients in the other wards had not been disturbed and the seriously ill patients of the convoy had soon culled from the rest and earmarked for special nursing or professional care within a short time of their admission.

Ordinarily, convoy patients were retained on the receiving ward until after breakfast the next morning. The mess officer's task was made easier thereby because last-minute changes in food deliveries at breakfast were limited to the receiving ward.

Laboratory personnel were on hand when the convoy was admitted to draw blood for hemoglobin determination and hematocrit on all patients. If the hemoglobin was found to be below 10 grams, the examining physician was immediately notified, and crossmatching for transfusion was done. A urine specimen was obtained on each patient. The importance of this cannot be over emphasized because the cause of death in 2 of our patients was lower nephron nephrosis. Neither patient had been recognized as having lower nephron nephrosis prior to admission to our hospital. Although it is not implied that either death might have been prevented by earlier diagnosis, the responsibility for early diagnosis rests heavily on the medical officers attending the patient; and we believe that this type of screening can be done soonest and best on a smoothly running receiving ward.

Under normal operating conditions, all patients were received between the fourth and seventh day following injury. Debridement and primary care had been accomplished and most wounds were ready for reparative operation. In the receiving ward the chiefs of sections were able to examine and evaluate all admissions to their sections. This saved a large amount of walking about, searching for the new patients, and not a few unpleasant surprises. Often preliminary examination on the receiving ward enabled the chiefs or members of their sections designated by them to schedule patients for operation on the following day, or to order roentgenograms or laboratory procedures. In this way 24 hours were frequently clipped from the time required to obtain information vitally needed.

Consultations between sections and services were facilitated. Many hours were saved because representatives of the major services were on hand or on call for on-the-spot decisions rather than awaiting the lengthy process of submitting consultation requests.

#### RECOVERY WARD

A recovery ward is staffed by personnel trained in the problems of the immediate postoperative state and is equipped with aspirating machines, oxygen for nasal catheter and mask administration, a Levin suction apparatus, a Stedman pump, a bronchoscope, et cetera. All necessary medicines are also available.

With the advancement in surgical and anesthesiologic technics it has become evident that the reduction of patient morbidity and mortality depends on the treatment given during the period from the completion of the operation until the patient has regained his reflexes. In the immediate postoperative period hypoxia may appear by stealth if the respiratory airway is not carefully observed and maintained. The position of the patient may cause respiratory obstruction or embarrassment which may portend an atelectasis. Marked reduction in blood pressure may occur or a severe excitement state may result in injury. Dressings and casts applied tight enough to embarrass circulation may go unnoticed for hours unless trained personnel are alert to this possibility. Prolonged or shock-producing operations seriously weaken a patient so that further trauma in the immediate postoperative period might result in prolonged morbidity or even death.

The recovery ward should be adjacent to the surgery so that the patient does not travel a great distance in his depressed state. The surgery and the recovery ward must be considered an integral unit under the control of the anesthesiologist.

Depending on the daily operating schedule there should be one or more nurses in the recovery ward whose duties will be to care for the patients brought there, to give immediate supervision to the enlisted medical personnel, to administer medications, and to see that suitable charts are kept so as to reflect the patient's postoperative state while in the recovery ward. The enlisted personnel move patients from the litter to the bed, assist in positioning them in bed, and in moving them about. They can also be taught to watch the patients for signs of respiratory or other distress and to correct the condition or seek assistance. Proper functioning of the recovery ward depends on these enlisted attendants and every attempt must be made to instill in them confidence and pride in their work. They spell the difference between success and failure for the mission

of the recovery ward because there will be insufficient nurses to provide personal observation of all the postoperative patients. These men must be acutely aware of the tremendous value of their vigilance to the patient. One enlisted man in the recovery ward to each 2 or 3 patients occupying beds at maximum capacity is not excessive when considering the returns in health, time saved, and confusion avoided.

Transportation of the patient from the operating room to the recovery ward is by litter equipped with restraining straps. A Gatch bed is used if available. Suitable blocks or a chair are used to elevate the foot of the bed. A rubber sheet over the mattress and additional sheets and blankets are at hand to provide warmth if needed. An emesis basin, towels, and a drinking glass are contained in the bedside table, the top of which can be used to hold the patient's food tray. The enlisted attendants are taught to insert airways in patients with partial obstruction of the respiratory passages if positioning of the head is ineffective. A portable anesthesia machine is kept near the recovery ward to be used for maintaining artificial respiration on a patient whose lung excursions are shallow or have ceased. A positive-pressure resuscitator can be substituted if necessary. The personnel should know how to supply oxygen to the patient with either of these machines until additional aid is forthcoming.

A change of dressings is facilitated by the use of a wheeled dressing cart. It should be supplemented by a sterile pack containing syringes, needles, a knife, procaine, and epinephrine for emergency use in treating cardiac arrest. Another sterile pack should contain the bronchoscopes to be used for aspiration of the bronchial tree.

A standard stimulant tray found on all wards and containing aromatic spirits of ammonia, amyl nitrite, atropine, caffeine and sodium benzoate, injectable digitalis, epinephrine, metrazol, and nikethamide can be supplemented with apomorphine, sodium amyta or pentothal sodium, and picrotoxin. Fluids for parenteral use are stocked with suitable tubing. A sufficient number of fire extinguishers and hand litters for evacuating patients in case of fire must be available. The recovery ward is well placarded to keep the curious from trespassing and signs proclaiming the use of oxygen and prohibiting smoking are prominently displayed.

The depressed postoperative patient must be observed carefully until he regains consciousness or all his reflexes. To leave him in the care of untrained personnel can jeopardize his recovery. To place him on a large general ward in this condition

disrupts the normal routine unnecessarily, and the personnel may be too busy through sheer numbers of patients to supply the proper care. The use of a recovery ward results in economy of lives, health, time, and material.

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### BOOK REVIEWS

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*Diseases of the Chest*, by *T. Royle Dawber*, A. B., M. D., F. A. C. P., Senior Surgeon, U. S. P. H. S.; Chief of Heart Disease Epidemiology Study, National Heart Institute; Assistant in Medicine, Harvard Medical School, and *Lloyd E. Hawes*, A. B., M. D., D. A. B. R., Radiologist at Faulkner Hospital; Consultant at U. S. P. H. S. Hospital, Boston. 440 pages; illustrated. The Williams & Wilkins Co., Baltimore, Md., publisher, 1952. Price \$10.

This book has the advantage of having been written by an internist and a roentgenologist in collaboration. The first 2 chapters offer a concise review of the elementary aspects of the anatomy, respiratory mechanism, and methods of study of the chest. A discussion of the chest wall from a roentgenologic standpoint follows. This excellent chapter describes common artefacts, congenital abnormalities, and bony lesions as seen in roentgenographic studies. ensuing chapters cover diseases of the chest by organs involved in a manner which will be of the greatest value to the many doctors who must review numerous roentgenograms of the chest and treat varied chest diseases in the course of a busy practice. This book is not designed as an all-inclusive reference work. Technics are wisely omitted. The general medical and roentgenologic aspects of chest disease are well correlated. Of particular value are the innumerable hints on interpretation of roentgenograms recognizing the pitfalls of such interpretation. Diagnostic points which are not usually found in textbooks are mentioned for each disease. The author's style is simple and direct. The numerous illustrations of typical roentgenograms are very informative. The book is well bound and the paper is of high quality. An appropriate bibliography is included. It is believed that general practitioners, internists, and general surgeons will gain much useful information from this book.—*Lt. Col. B. A. Nichol, MC, U. S. A.*

*History of American Psychology*, by *A. A. Roback*. 426 pages; illustrated. Library Publishers, New York, N. Y., 1952. Price \$6.

This is a compact, superbly written account of the principal events and trends out of which modern American psychology has been fashioned. It passes over the bulk of genealogic detail

which links our psychology with forerunning British and Continental European developments, that task having been accomplished by Boring. Instead, it directs attention to the scarcely explored pre-experimental epoch of the 250 years prior to William James' *Principles*. The impact of British and European traditions is seen largely through intimate accounts of such American teachers as Munsterberg, Titchener, Hall, and Cattell. Pre-experimental and experimental epochs in America are linked, and the ensuing developments are followed to the present day. A delightful authenticity pervades the book because the author's own professional life has overlapped those of the great figures of the American experimental period.

The book is divided into 4 parts. The first deals with the pre-experimental theologic orientation of psychology as taught at Harvard, Yale, Princeton, Columbia, and the University of Pennsylvania. Typical subject matter of the period is cited, prominent teachers are portrayed, and important books and publications are noted. Broad German and Scottish influences are elucidated. The second part covers the formative years of the experimental period, highlighted by the opening of laboratories throughout the East and Middle West. This part is by far the most rewarding, for it contains intimate personal views of the early great figures of the contemporary period. The third part traces the diversification of views culminating in the development of "schools." Part 4 views the various "branches" of effort, such as educational, applied, experimental, and physiologic, and offers a few speculations about the future. Scattered throughout the book are reproductions of what surely must be rare photographs of psychology's greater teachers.

This scholarly work is worthy of the attention of all psychologists, young or old, and it should be declared required reading for graduate students in psychology. It will appeal less to non-psychologists, largely because the author has left the telling of much important detail to other historians. Even the educated layman, however, will enjoy the often bold and witty reflections on the foibles of our early masters. The spectacle of Roback taking Boring to task in matters pertaining to the defense of their respective heroes is well worth the price of the book.

—Major R. B. Payne, U. S. A. F. (MSC)

# AN IMPROVED APPARATUS FOR INTRA-ARTERIAL TRANSFUSION<sup>(1)</sup>

CARTER L. MEADOWS, *Major, MC, U. S. A.*

ROY L. ROBERTSON, *M. D.*

THE use of iatra-arterial transfusion as a method of replacement therapy has become well established in the treatment of acute hemorrhage and traumatic shock. The principles underlying the use of this method and the experimental and clinical considerations have been dealt with in previous reports (2-6). Certain inherent advantages of the iatra-arterial method over the conventional intravenous procedure merit consideration by the military surgeon.

Among these advantages are rapid restoration of both blood pressure and blood volume and immediate perfusion of the cerebral, coronary, and renal arteries under the desired pressure. In addition, the same volume of blood given by the arterial route appears to have an improvement factor of about 2 to 1 over intravenous replacement (7). Disadvantages include the necessity for special apparatus, the possibility of leaks or disruption of the apparatus under pressure, sacrifice of the artery following cannulation, danger of air embolism, and the possibility of tissue necrosis in the extremity subjected to prolonged infusion, unless it is periodically allowed to be perfused with oxygenated blood. This report will describe a modified apparatus which has several advantages over types previously used.

## PREVIOUS METHODS

In the apparatus previously used for the administration of blood intra-arterially and intravenously under pressure, the

(1) From the Whitehead Department of Surgery, Emory University School of Medicine, Emory University, Ga.

(2) Seeley, S. F.: Intra-arterial transfusion in profound shock. *Anesth. & Analg.* 30: 195-210, July-Aug. 1951.

(3) Page, I. H.: On certain aspects of nature and treatment of oligemic shock. *Am. Heart J.* 38: 161-192, Aug. 1949.

(4) Glasser, O., and Page, I. H.: Prognostic signs in experimental hemorrhagic shock. *Cleveland Clin. Quart.* 13: 125-127, July 1946.

(5) Kohlstaedt, K. G., and Page, I. H.: Hemorrhagic hypotension and its treatment by intra-arterial and intravenous infusion of blood. *Arch. Surg.* 47: 178-191, Aug. 1943.

(6) Gold, L. B.; Rosenthal, J. L.; and Schott, S.: Rationale of intra-arterial transfusion with case report. *Anesth. & Analg.* 28: 319-329, Nov.-Dec. 1949.

(7) Seeley, S. F.: Personal communication.

application of air pressure has been (1) either directly over the blood in the transfusion bottle or with the interposition of a small glass reservoir; or (2) from a cylinder of compressed air or oxygen, controlled by means of a reducing valve, as described by Ziccardi and Madden (8) and Porter et al. (9).

Each of these methods has certain disadvantages. In the first instance, because the transfusion bottle provides a limited air reservoir, the passage of relatively small amounts of blood from the bottle into the patient's arterial system results in sudden and sharp drops in the air pressure over the blood. Constant vigilance is required on the part of the operator to maintain the desired pressure. In the second method, the use of compressed air or oxygen with reducing valves necessitates the transportation of heavy equipment with attendant inconvenience and expense; the reducing valves require constant regulation and repair; the continued flow of gas under pressure into the transfusion bottle may cause an explosion or other disruption of the system; and passage of an air bubble from the bottle into the artery may produce an air embolism.

The apparatus used until recently in the Emory University Hospitals, and previously described by Robertson et al. (10) was of the first type, in which air pressure is applied directly over blood in a small reservoir by means of a sphygmomanometer bulb. Experience showed that as the number of connections from glass to rubber were increased, the likelihood of leaks and disruptions of the apparatus and the consequent necessity for interrupting or discontinuing the transfusion likewise increased. Other modifications of the apparatus were therefore undertaken.

#### PRESENT METHOD

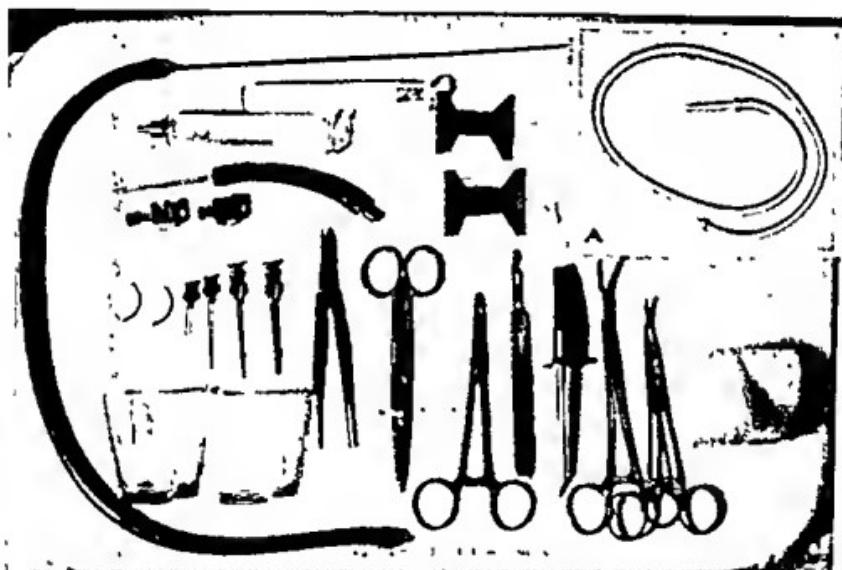
A large air reservoir in which air pressure could be applied directly over blood in the transfusion bottle was designed. The passage of a given amount of blood from the bottle would then cause a relatively small drop of pressure in the reservoir because of the disproportionate volumes of fluid and air. This was first accomplished by the use of a 1-gallon glass bottle. This was inconvenient because of the possibility of breakage and the danger of sudden rupture or explosion of the bottle while being subjected to air pressure.

(8) Ziccardi, A. V., and Madden, J. L.: Apparatus for intra-arterial transfusion. *Am. J. Surg.* 81: 470-473, Apr. 1951.

(9) Porter, M. R.; Sanders, E. K.; and Lockwood, J. S.: Factors of rate of transfusion with particular reference to intra-arterial route. *Am. Surg.* 128: 865-880, Oct. 1948.

(10) Robertson, R. L.; Trasher, L. H.; and Dennis, E. W.: Intra-arterial transfusions: experimental and clinical considerations. *Surg., Gynec. & Obst.* 87: 693-704, Dec. 1948.

Accordingly, a modified form of the apparatus was constructed. A low metal stand with a plywood top was mounted on casters. An ohleng steel tank, such as that used for surplus oxygen in aircraft, was placed beneath the top and anchored from above. A metal pump (hicycle or football type) was mounted in the frame adjacent to the tank and connected by a rubber tube and a nipple to the lower end of the pressure tank. The upper end of the tank has a T-connection from each end of which a short length of rubber tubing extends to an aneroid manometer



*Figure 1. Contents of sterile arterial cannulation tray. Insert A shows slotted filter with rubber-tubing connection for very rapid administration.*

which registers pressure. From the other end of the connection, a length of tubing extends for about 2 feet, at the end of which there is a small metal coupling which may be disassembled and which is identical with that used in sphygmomanometer cuff connections. The flat surface of the top of the stand provides space for the arterial cannulation tray and may be used for temporary storage of transfusion bottles or expendable plastic recipient filter sets (11).

The sterile arterial cannulation tray (fig. 1) contains a syringe, hypodermic needles, medicine glasses for administration of local anesthesia if it is required to prevent arterial spasms, 2 metal cannulas (16-gage and 12-gage), one 12-gage glass

(11) These filters, which are adapted for use with pressure, may be obtained from the Baxter Laboratories.

cannula connected by rubber tubing to a needle adaptor, a scalpel, a slotted stainless steel filter with a short length of rubber tubing which is to be inserted between the plasma bottle and the expendable plastic recipient set, scissors, hemostats, forceps, pinchocks, towels, gauze dressings, a long, large-bore plasma-aspirating needle with a length of tubing by which it is connected to the other half of the metal sphygmomanometer coupling and tube (through which air pressure from the reservoir is introduced over the blood), a needle holder, curved needles, and suture material.

Insert A shows a short rubber tube joined to the slotted stainless steel filter. When more rapid arterial transfusion is indicated, the plastic recipient set with its lengthy tube may be removed and the short tube connected directly with the cannula in the radial artery. By using this modification, blood has been delivered satisfactorily at the rate of 500 cc. in 1½ minutes, whereas twice that length of time is required to deliver the same amount of blood when the slotted metal filter and the plastic recipient set are used together. Although small particles theoretically can pass from the bottle to the patient by this means, we have not as yet had any such complications. Figure 2 shows the apparatus assembled and ready for use and figure 3 shows it in use.

Assembly of the apparatus and administration of the arterial transfusion can be quickly accomplished by a single operator. The assembled unit is rolled to the bedside or operating table, the sterile arterial cannulation tray is opened, and surgical exposure and cannulation of the selected artery is performed. The cannula is securely anchored in the artery with the end pointing proximally and the artery distal to the site of cannulation is ligated. Next, the plastic expendable recipient set is joined to the slotted filter and the filter is thrust into the thin portion of the rubber stopper of the transfusion bottle. The plasma needle is then pushed through the thick portion of the rubber diaphragm and its tube is coupled to that leading from the pressure reservoir under the table. The transfusion bottle is then inverted on a low hypodermoclysis stand. Pressure in the air reservoir is quickly raised by a few strokes of the bicycle pump, causing air to enter the transfusion bottle and to force blood out through the slotted filter into the recipient set and tubing. As soon as the tubing is completely filled and no air remains within the system, the stylet is removed from the cannula in the artery and the needle adaptor of the plastic transfusion set is inserted in its place. The transfusion is then ready for administration at the desired pressure and speed.

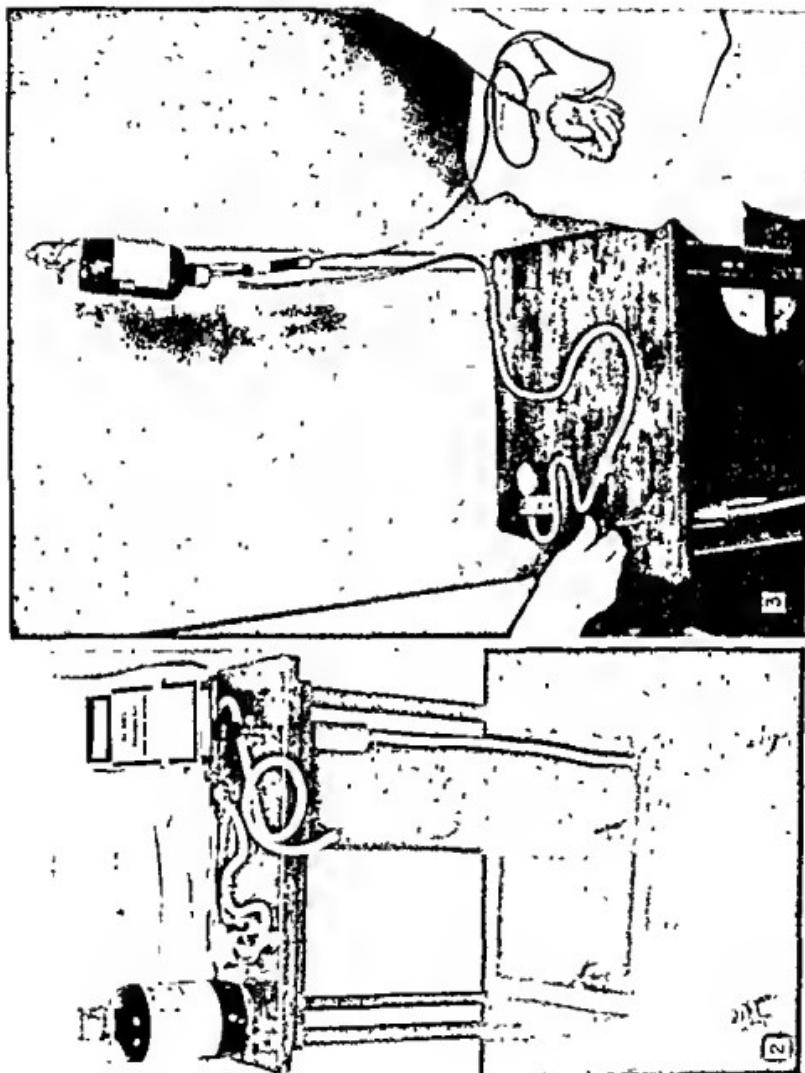


Figure 2. Apparatus assembled and ready for use. Figure 3. Apparatus assembled and in use.

As the transfusion bottle empties, care must be exercised to prevent air from entering the filter system and subsequently the artery and thus causing air embolism. When about 50 cc. of blood still remains in the bottle, preparations are made to exchange the bottle for a full one.

By placing a clamp across the tube leading from the pressure reservoir and removing the plasma aspirating needle from the transfusion bottle, equilibrium is reached between the pressure in the bottle and in the patient's artery, and a clamp is then placed across the tube leading directly to the patient. The slotted filter is removed from the depleted bottle and it and the plasma needle are both thrust into the top of the fresh bottle in the same manner used with the original container. This exchange can be accomplished in less than 30 seconds.

The advantages in using the described apparatus are: (1) the speed with which the apparatus can be assembled and blood can be delivered under pressure to the patient; (2) the rapidity with which an empty transfusion bottle can be replaced by a fresh one; (3) the ability of a single operator to assemble the apparatus and accomplish the transfusion; (4) the elimination, to a large extent, of the possibility of disruptions or leaks in the connecting tubing and apparatus; (5) the use of a relatively large reservoir of air to deliver pressure over the blood, assuring a fairly steady flow of blood at the desired pressure without the constant need for pumping; and (6) the relatively easy accessibility and inexpensiveness of the apparatus, the lightness and portability of the entire unit, and the fact that it can be assembled with sterile and unsterile parts and kept together as one unit.

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# PRIAPIST IN SICKLE CELL ANEMIA

BRUCE F. CHANDLER, *Captain, MC, U. S. A.* (1)

EMMET L. KEHOE, *Colonel, MC, U. S. A.* (1)

**P**RIAPIST is a condition of persistent and prolonged erection of the penis, unaccompanied by sexual desire, usually painful, and not relieved by intercourse (2). The condition is not common but may arise from a variety of causes (3). A very infrequent cause of priapism is sickle cell anemia. In a complete review of the literature Campbell and Cummins (2) found only 16 reported cases. They added 5 cases of their own collected over a period of 10 years. The following case is presented to emphasize that, in a Negro, the presence of priapism should direct attention to the possible diagnosis of sickle cell anemia.

## CASE REPORT

A 23-year-old Negro was admitted to this hospital on 19 September 1951. While en route to his home on emergency leave, he stopped in this city to visit relatives. After a drinking party and following sexual intercourse, his penis remained in a state of persistent, painful erection. He sought medical help at a civilian hospital 12 hours after the onset and was transferred to this hospital 5 hours later.

On admission, he appeared in acute distress. His temperature was 100.4° F.; his pulse was 100; his respirations were 24; and his blood pressure was 170/80. His scleras appeared slightly icteric. Scars were noted on the ulnar aspects of both hands and on the lateral aspect of his left foot, where accessory or sixth digits had been removed when he was 2 years old. His heart was not enlarged but on auscultation a systolic murmur, grade 2 in intensity, harsh and scratchy in character, was heard best in the second intercostal space just to the left of the sternum and was transmitted to his neck and apical areas. His penis was erect and turgid, but was not warm to the touch.

His hemoglobin was 8.9; his erythrocyte count was 2,850,000, and his leukocyte count was 14,600, with 68 percent neutro-

(1) Walter Reed Army Hospital, Washington, D. C.

(2) Campbell, J. H., and Cummins, S. D.: Priapism in sickle cell anemia. *J. Urol.* 66: 697-703, Nov. 1951.

(3) Bailey, H.: Persistent priapism. *Brit. J. Surg.* 35: 299-303, Jan. 1948.

phils, 31 percent lymphocytes, and 1 percent eosinophils. SICKLING of the red blood cells was noted on the differential smear. Urinalysis showed a 1 plus qualitative test for protein, about 7 leukocytes, and from 1 to 5 erythrocytes per high power field. The icteric index was 25. The total serum bilirubin was 1.6 mg. per 100 cc. The serologic test for syphilis was negative.

On admission, he was given 2 cc. (60 mg.) of papaverine hydrochloride intravenously, without relief of the erection, and 20 mg. of diethylstilbestrol iotranuscularly. This was followed by 16 mg. of morphine sulfate and 0.4 mg. of atropine sulfate subcutaneously were given every 4 hours. These also gave him no relief. He was taken to the operating room 12 hours after admission and tetracaine hydrochloride spinal anesthetic was administered. Thirty minutes of spinal anesthesia failed to reduce the priapism and bilateral longitudinal incisions, 1 inch in length, were made in the corpora cavernosa near the base of the shaft of the penis. One hundred cubic centimeters of thick, dark, unclotted blood were removed and the organ became flaccid. This was followed by sustained hemorrhage of fresh arterial blood and by the time hemostasis was obtained with gelfoam gauze and suture ligatures, the organ was as erect and turgid as before.

Following the attempted surgical correction, treatment consisted of conservative measures. A total of 2,300 cc. of whole blood was given. Diethylstilbestrol, chloramphenicol, analgesic applications to the penis, and hot Sitz baths were also used. The penis slowly lost its turgidity and by 27 October, 46 days after the onset of the priapism, was completely flaccid. The patient was completely impotent for 4 months, but by March 1952, he was able to obtain a partial erection.

Urinalyses repeatedly showed proteinuria and failure to concentrate above 1.014 even after Fishberg tests. The patient's cardiac murmur was thought to be due to his sickle cell anemia. The percentage of sickled forms in the circulating blood, without the addition of anoxic factors, was as high as 24 percent, and persistent leukocytosis was noted.

#### DISCUSSION

Diggs and Ching (4), in a discussion of the pathology of sickle cell anemia, were the first to note any relationship between this disease and priapism. One of their patients had definite residual fibrosis after the acute penile engorgement had subsided. They believed that the cause of the priapism was thrombus formation caused by the interlocking of the elongated, sickled erythrocytes in the narrow vascular spaces of the penis.

(4) Diggs, L. T., and Ching, R. E.: Pathology of sickle cell anemia. *South. M. J.* 47: 837-845, Oct. 1954.

Getzoff (5) found that, in the period from 1936 to 1941 at the Charity Hospital of New Orleans, of 57,455 Negroes admitted, 65 had sickle cell anemia, 11 had a chief complaint of priapism, and only 3 had both. He postulated that the explanation for priapism in sickle cell anemia was the occurrence of venous congestion in the penis which lowered the oxygen tension, thus causing increased sickling which produced further stasis, more sickling, and eventual thrombosis and occlusion of the vascular channels for venous return. The blood was then pooled in the sinuses, which was conducive to more sickling and further persistent erection of the organ.

The onset of priapism is usually sudden and may occur at any age. The ages of the reported cases ranged from 5 to 33 years. Priapism may be the first complaint of a patient with sickle cell anemia (5). The condition may occur spontaneously, or it may be initiated by sexual intercourse, but it then persists, as it did in this case, after sexual desire has been satisfied and is not relieved by further intercourse. It is usually painful and may be accompanied by fever and by difficulty in urinating. In contrast to the usual transitory erection, in true priapism only the corpora cavernosa become erect and the glans penis and corpus spongiosum penis are not involved (6).

Treatment, as a rule, is prolonged. Both conservative and surgical means have been employed, usually with none of the measures meeting dramatic success. In the conservative sphere, local heat or cold, analgesic agents, general or spinal anesthesia, diethylstilbestrol, papaverine, anticoagulant therapy, antibiotics, rectal diathermy, and multiple blood transfusions have all been used. Surgical measures have included ligation of the dorsal artery of the penis, division or alcohol injection of the pudendal nerves, division of the ischiocavernosus muscles, simple needle aspiration of the corpora cavernosa, or their incision and drainage. The last two methods are the safest surgical procedures and have produced occasional successful results. Ordinarily the priapism of sickle cell anemia has required from 10 to 47 days to subside (5).

Impotence follows priapism in many patients, especially when incision and drainage of the corpora cavernosa has been employed. Campbell and Cummins (2) stated that, of the 7 patients with priapism and sickle cell anemia in whom this therapy had been used, all became impotent. Our patient was, however, able to maintain a partial erection 6 months later.

(5) Getzoff, P. L.: Priapism and sickle cell anemia; report of 3 cases. *J. Urol.* 48: 407-411, Oct 1942.

(6) Haggison, F. G.: Priapism; report of 3 cases. *Pennsylvania M. J.* 50: 1074-1077, July 1947.

## "Cancer Cures" and Mr. Hoxsey's Nostrums

Physicians concerned with the welfare of the frequently misled public will be delighted at the recently ordered injunction against interstate shipment by Mr. Harry M. Hoxsey or the Hoxsey Cancer Clinic of "brownish-black, and pink, colored liquids intended for use in the treatment and cure of cancer in man." On 31 July 1952, the U. S. Court of Appeals for the Fifth Circuit, at New Orleans, reversed the judgment of the trial Judge of the U. S. District Court at Dallas, Tex., stating that, "The facts of the case require the issuance of an injunction, and the Court's failure to do so evidences an abuse of discretion."

Mr. Hoxsey's clinic had been shipping his medicines to osteopaths or directly to patients in many parts of the country. The liquids, intended for oral administration, contained potassium iodide and such items as clover blossom, alfalfa, and cascara sagrada. The District Court, in concluding that some cancer cures had been wrought by these mixtures, admitted the testimony of lay patients, unsupported by any proof that they had ever had cancer, to the effect that the Hoxsey medicines had cured them. The Circuit Court opinion, in reversing the judgment, laid down the following principles, based on testimony by cancer experts:

"\* \* \* there is only one reliable and accurate means of determining whether what is thought to be cancer is, in truth and fact, actually cancer. This requires a biopsy, a microscopic examination of a piece of tissue removed from the infected and diseased region." " \* \* \* the opinion of a layman as to whether he has, or had, cancer, or a like opinion as to whether he has been cured and no longer bears the disease, if, in fact, it ever actually existed, is entitled to little, if any, weight." " \* \* \* despite the vast and continuous research which has been conducted into the cause of, and possible cure for, cancer the aggregate of medical experience and qualified experts recognize in the treatment of internal cancer only the methods of surgery, X-ray, radium and some of the radio-active by-products of atomic bomb production."

Unfortunately, the Hoxsey Cancer Clinic still flourishes unhampered in Dallas, Tex., so long as it keeps out of interstate commerce, but the action of the U. S. Court of Appeals gives hope that something effective may be done about the perennial rash of quack remedies for cancer with which the suffering public is plagued.

# POSTOPERATIVE ACRYLIC PALATAL STENT

WILLIAM V. HILL, *Lieutenant Colonel, DC, U. S. A. (1)*

JOHN L. SOLIMINE, *Captain, DC, U. S. A. R. (1)*

**L**ARGE areas in the palate devoid of mucoperiosteum following the surgical removal of tumors or following severe lacerations due to accidents often present a problem of postoperative management. Heat, cold, and the passage of food all contribute to the discomfort of the patient during the healing period. The relatively poor blood supply and nature of the tissue of some areas of the palate are not conducive to rapid healing. When electrocautery is used, healing may be further delayed. In the case here described, a palatal stent was used.



*Figure 1. Tumor prior to excision showing 3 definite lobes.*

## CASE REPORT

A 23-year-old man was found to have a growth in the hard palate. This growth was lobulated, firm in consistency, pink, and attached to the palate with a broad flat pedicle. It measured 2.5 by 3.5 cm. and occupied about half of the palatal vault (fig. 1).

(1) Dental Clinic, Fort Monmouth, N. J.

The patient stated that no one had discovered this growth on examination before, although he had known of its existence as long as he could remember.



Figure 2. Excised tumor showing severed pedicle.

The growth was surgically removed under local anesthesia (fig. 2). The pedicle was removed from the palate with a scalpel, leaving an area of denuded bone about 1.5 cm. in diameter, the mucoperiosteum being attached to the pedicle. The growth on microscopic examination was found to be a fibroma. Prior to operation an alginate impression was taken of the upper arch and an acrylic stent was constructed. In trimming the tumor area from the cast, a 2-mm. thickness was left in the pedicle area in order



Figure 3. Acrylic palatal stent in place.

that a space of that thickness would exist between the finished acrylic stent and the pedicle area to be removed surgically. The remainder of the stent was to be in contact with palatal tissue.

The stent was prepared with holes in the interproximal space area of the first bicuspид and first molar area to allow for the passage of stainless steel wires to retain the appliance in the mouth (fig. 3). Following removal of the tumor, a cotton-waste dressing, saturated with balsam of Peru was applied over the denuded area. This was held in place by means of the stent and the dressing was retained for 48 hours, at the end of which time the balsam of Peru dressing was changed. This treatment was repeated for 10 days, by which time the denuded area was fully covered with tissue and well healed. At no time following the removal of the tumor did the patient have any discomfort. He was able to eat a normal diet. Cleansing washes after meals were unnecessary. The wound did not suppurate at any time.

The use of such appliances changes a normally painful, unpleasant, slowly healing wound to one which is painless, odorless, and rapidly healing and furthermore saves the time of both the patient and the operator.

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#### BOOK REVIEWS

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**The Clinical Application of Antibiotics, Penicillin,** by M. E. Florey, M. D., From the Sir William Dunn School of Pathology, Oxford. This volume, although a separate publication, is a continuation of the work described in **ANTIBIOTICS**, Volumes I and II, and may be read in conjunction with it. 730 pages; illustrated. Oxford University Press, New York, N. Y., publisher, 1952.

This authoritative and comprehensive work by one of the great pioneer investigators in the field of antibiotics will doubtless become the standard reference for all clinicians. After Sir Alexander Fleming's epoch-making discovery of the antibacterial properties of penicillin, it was Florey, along with Chain and others in England who did most of the original investigative work on the therapeutic properties of this invaluable drug.

The literature on antibiotics has grown tremendously in recent years. The bibliography alone in this book comprises about 73 pages and attests to the tremendous amount of preparatory reading done by the author.

The book is divided into 3 principal sections. The first is concerned with the properties of clinical importance and a general

consideration of the results of therapy; the second deals with the treatment of diseases due to specific organisms; and the third takes up the treatment of diseases considered by systems. The last section is of particular interest to medical officers because it includes an excellent chapter on the use of penicillin in battle casualties.

Unfortunately, in preparing a work of this magnitude, the time intervening between the review of the literature and the final publication is necessarily prolonged. Consequently, although the book was published in 1952, only the literature appearing up to the end of 1949 was considered. One suspects also that the chapters on rickettsial diseases and typhoid fever were written prior to the advent of chloramphenicol and terramycin because neither of these agents is mentioned in the text. Occasional mention, however, is made of aureomycin but not in these chapters.

The author has been scrupulously fair at all times in evaluating penicillin and has taken great pains to mention in the text any paper in which a well-based conclusion has run counter to the finding of most investigators. The chapters on the use of penicillin for infections within the thorax and for infections in infants are particularly well written and informative. This book should prove of unusual interest to all clinicians regardless of their specialties. Penicillin has proved to be of value in such a wide variety of medical and surgical conditions that it is difficult to conceive of a single medical specialty in which it has no place.

—Col. E. L. Kehoe, MC, U. S. A.

*Living With Diabetes*, by Edward Tolstoi, M. D. 90 pages. Crown Publishers, Inc., New York, N. Y., 1952. Price \$2.

This monograph, written for the layman, is a lucid exposition of the author's thesis that diabetics should disregard sugar in the urine and should eat whatever they want, taking sufficient insulin to assure well-being and freedom from acidosis. It is unfortunate that the controversy between those who advocate "chemical control" and those who advocate "clinical control" diabetes should be presented to the lay reader. This monograph will result only in dissatisfaction and bewilderment of the diabetic patients of most of the physicians who follow the recommendations of the American Diabetes Association.

—Col. F. H. Mourey, MC, U. S. A.

# AGENESIS OF THE ILEUM AND JEJUNUM

HUGH P. CURTIS, *Captain, MC, U. S. A. (1)*

WILLIAM W. NICHOL, *Colonel, MC, U. S. A. (1)*

**A**CASE of agenesis of the ileum and jejunum recently seen at this hospital is of sufficient interest from a diagnostic and pathologic standpoint to include in the case reports of such abnormalities.

## CASE REPORT

A 6-pound 1-ounce, full-term, male infant was delivered on 23 March 1952 of a 22-year-old mother, gravida I, Para 0, whose pregnancy had been uneventful and in whose family there was no history of congenital abnormality. Physical examination 8 hours after delivery revealed a slightly cyanotic infant who otherwise appeared perfectly normal. The patient was placed in an incubator and oxygen was administered shortly after birth and the cyanosis cleared about 9 hours later. Shortly after birth the patient vomited yellow material. He seemed hungry and attempted to eat but always regurgitated the food and water that was offered. This continued until 30 hours after birth, at which time it was noted that he had passed no meconium. A thermometer was inserted into the rectum and could be passed only about  $\frac{1}{4}$  of an inch. A gelatinous white material was expressed from the rectum but no meconium was found. Rectal examination revealed a normal anus, but about 1 inch inside the rectum the finger was stopped by an obstruction.

Roentgenograms of the patient at this time showed dilated intestinal shadows which in the inverted position ended about 1 cm. proximal to the tip of a radiopaque instrument inserted into the rectum (fig. 1). The lateral view in this position showed the gas-filled loop of bowel to lie slightly anterior to the rectum. It was thought that the dilated bowel represented large bowel and that the patient had an atresia of the large bowel about 3 cm. proximal to the anus. An attempt to administer a barium enema was unsuccessful. The patient was prepared for operation and about 36 hours after birth his abdomen was explored through a left rectus incision under open drop ether anesthesia.

A markedly dilated small bowel immediately filled the wound and exploration revealed that the small bowel ended in a blind pouch in the right lower abdominal quadrant with only a fine band connecting the terminal portion of the small bowel to the cecum which was about 1.5 cm. beyond the end of the small bowel. The cecum and entire large bowel was about 1 cm. in diameter and contained cheesy white material which could be moved through its lumen. The small bowel was much shorter



Figure 1. (A) Posteroanterior roentgenogram. (B) Lateral roentgenogram. Note dilated loops of intestines.

than normal. Saline solution injected into the mid-transverse colon was seen to dilate the colon proximally and distally. A side-to-side anastomosis between the end of the small bowel and the mid-transverse colon was performed using interrupted No. 0000 silk and continuous No. 0000 catgut on the posterior row, and a single layer of inverting Connell No. 0000 catgut sutures on the anterior row. The small bowel was opened proximal to the anastomosis following its completion and a catheter could be passed into the proximal and distal limbs of the large bowel. This opening was then inverted with two rows of sutures and attention was directed to the sigmoid colon which was about 1 cm. in diameter. Because the question of atresia of the rectum

was as yet unanswered, a loop sigmoid colostomy was performed and the wound was closed without event. The patient withstood the procedure well, receiving 45 cc. of whole blood and 350 cc. of 5 percent dextrose solution intravenously.

A small urethral catheter was inserted into his stomach pre-operatively and was connected to Wangensteen suction apparatus postoperatively. Forty-eight hours postoperatively his colostomy was opened; a catheter was inserted into the colon proximally for irrigation; and 10 cc. of mineral oil was injected through the tube in order to dilate the large bowel and facilitate the passage of its contents. The patient was maintained during this time on intravenous fluids, penicillin, and streptomycin. On the fourth postoperative day hydration was excellent, he cried well, and was vigorous. The urethral catheter was removed from his stomach and he was given dilute glucose water by mouth. On the same day a small amount of green-black material passed from the tube in his colon and it was believed that the colostomy was functionally communicating with the small bowel. It was further noted that following instillation of mineral oil into his rectum, oil was obtained in his gastric aspiration. No more mineral oil was given by rectum.

On the fifth postoperative day small amounts of high protein, low-fat milk were added to his formula which he was offered every 2 hours. By the afternoon of that day he was vomiting intermittently and the urethral catheter was reinserted into his stomach. His formula was given through the urethral catheter, suction being applied to the catheter prior to each feeding. On the sixth postoperative day his weight was 5 pounds. He vomited a large amount of yellow material which was believed to be bile-stained milk curds. On the afternoon of that day he developed rapid and labored respiration with a temperature of 103° F. His color became ashen and he was seen to lie quietly in his incubator. Examination revealed numerous rales in both lungs. He was given 50 cc. of normal saline solution by intravenous drip and 30 cc. of whole blood by transfusion. His color remained waxy; his respiration became more labored; and he died.

On postmortem examination the lungs were red, firm, and did not float in water. On compressing them, a milky white mucoid fluid exuded from the surface. Microscopic examination revealed an extensive lobular inflammatory reaction which filled the alveolar spaces of the small bowel with acute inflammatory cells and fibrin. The duodenum and the portion of the jejunum still present were partially dilated. The small bowel contained only 15 cm. beyond the ligament of Treitz, indicating agenesis of most of the jejunum and all of the ileum. The side-to-side anastomosis between the jejunum and transverse colon was intact. The colon had dilated to about 2½ times its size at the

time of operation. Water injected into the sigmoid colon was seen to pass out the anus, indicating that no atresia of the rectum was present. With the small bowel freed from the remainder of the abdominal contents it was seen to measure, from the pylorus to its blind ending, a total of 23 cm. against a normal of 350 cm. (2).

Final diagnosis was (1) intestinal obstruction, due to agenesis of the ileum and most of the jejunum, with atresia of the connection between small and large bowel and (2) lobular pneumonia, secondary to aspiration of fluid.

#### COMMENT

The diagnosis of rectal atresia in this patient was based on (1) the presence of intestinal obstruction; (2) the apparent rectal obstruction, both to digital examination and to the attempted barium enema; and (3) more importantly, the roentgenographic findings of a dilated bowel which seemed to terminate just proximal to the rectum. Petts (3) has pointed out that positive differentiation of duodenal, ileal, and colonic obstruction is difficult in the infant because of the enormous dilatation, with the loops crowding one another into abnormal positions. The point might be made that in patients with suspected rectal stosis (type 4 of Ladd and Gross (4)), abdominal exploration is indicated to prevent an error in diagnosis such as was made in this patient. This would lend further support to Ladd and Gross' advice that those patients with type 4 rectal atresia should be treated by abdominal exploration and colostomy.

The actual pathology in this patient was agenesis of the major portion of the small bowel involving the entire ileum and nearly all of the jejunum, there being only 23 cm. of small bowel present as compared to the normal length of 350 cm. with an atresia of the connection between small and large bowel. From an anatomic standpoint a so-called microcolon was present, but, as pointed out by Lee and MacMillan (5), microcolon is not a primary disease entity but is always secondary to proximal obstruction.

Atresias of the small bowel have been a highly fatal abnormality in the past. The survival rate depends to a large extent on the location of the atresias, those proximal to the ligament of

(2) Watson, E. H., and Lowrey, G. H.: *Growth and Development of Children*. Year Book Publishers, Inc., Chicago, Ill., 1952.

(3) Petts, F. J.: Congenital stenosis of intestine and colon. *Surg., Gynec. & Obst.* 85: 14-19, July 1947.

(4) Ladd, W. E., and Gross, R. E.: *Abdominal Surgery of Infancy and Childhood*. F. B. Saunders Co., Philadelphia, Pa., 1941. pp. 25-43.

(5) Lee, C. M., Jr., and MacMillan, B. G.: Fallacy in diagnosis of microcolon in newborn. *Radiology* 55: 807-813, Dec. 1950.

Treitz having a more favorable prognosis than those distal to it (6). This patient had agenesis of a large portion of the small bowel in addition to the atresia and, because of the agenesis, the condition was probably incompatible with life from a nutritional standpoint. The immediate cause of death was aspiration pneumonia, which accounts for a high percent of the deaths of infants with congenital abnormalities of the gastrointestinal tract.

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(6) Rickham, P. P.: *Neonatal surgery; early treatment of congenital malformations*. Lancet 1: 332-339, Feb. 16, 1952.

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### BOOK REVIEWS

*Applied Physiology*, by Samson Wright, M. D., F. R. C. P., John Astor Professor of Physiology, University of London, Middlesex Hospital Medical School; Sometime Examiner in Physiology to the Universities of Oxford, London, and Leeds; The Royal College of Surgeons of England; The Royal College of Surgeons of Edinburgh; The Conjoint Board in England; The Conjoint Board in Ireland, with the collaboration of Montague Maizels, M. D., F. R. C. P., Professor of Clinical Pathology, University of London, University College Hospital Medical School, and John B. Jepson, M. A., B. Sc., D. Phil., A. R. I. C., Senior Lecturer in Biochemistry, Courtauld Institute of Biochemistry, Middlesex Hospital Medical School. 9th edition. 1,190 pages; illustrated. Geoffrey Cumberlege Oxford University Press, New York, N. Y., publisher, 1952.

Here is an old standby in a new, enlarged, and thoroughly rewritten and revised edition which is better than ever. As in the previous editions, Dr. Wright has produced a succinct, clear, and logical presentation of physiology which answers the questions posed by the investigator or practicing physician while fulfilling admirably its primary mission as a textbook. His method of writing in outline with short, terse statements and paragraphs facilitates the comprehension and use of current physiologic knowledge. The discussions of vomiting, defecation, and coitus are examples of the crisp manner in which Dr. Wright reviews a subject which is rarely taught as an organized whole, but is often asked in final or state board examinations.

Among the new features of this edition are: (1) the greatly increased number of illustrations, with a guide for their proper use; (2) the use of a professor of clinical pathology and of a senior lecturer in biochemistry as collaborators to give to physiology the unity it merits as a foundation for understanding medicine and surgery; and (3) an outline following the table of contents, which separates the preclinical material from that having mainly clinical

or specialist interest. Thus, the book can be as generalized or specialized as the user requires, yet still attain its avowed purpose of filling the needs and interests of both undergraduates and postgraduates.

It is difficult to find anything for adverse criticism except that the cover soils easily, and a general objection to the growing (and I fear unavoidable) bulk of all modern scientific texts. Fortunately, the author has not succumbed to the encyclopedic urge and the 2-column format presently so popular.

—A. F. Lawton, M. D., Ph. D.

*Massage and Remedial Exercises in Medical and Surgical Conditions*, by Noel M. Tidy, Member of the Chartered Society of Physiotherapy; T. M. M. G. 9th edition, 519 pages, illustrated. The Williams & Wilkins Co., Baltimore, Md., publishers, 1952. Price \$6.

This book is written in the style of a "Merck Manual." Practically every disease entity or symptom complex known to medicine is discussed and physical treatment is recommended. Many of the statements are inaccurate, the discussion of disease processes is too brief to be of value; and the outlined treatment many times of no value or even possibly harmful.

This is the ninth edition of a book first published in 1932. With so many editions it is obvious that there has been considerable circulation. Apparently this book has been used extensively in England as a text for physical therapists. It might have some advantage to the senior physical therapy student who must have a broad but limited knowledge of many diseases in order to pass a final examination. This probably is the use made of this book in England.

From the standpoint of the American reader, I can see no value in this book. The physician interested in physical medicine has so much more accurate knowledge of disease processes than is presented here that his intelligence would be insulted by Tidy's approach. The training of physical therapists in this country is such that they would find the material as presented in this text juvenile and of little use either in passing an examination or treating patients.

It is regrettable that some previous reviews of this book have been so complimentary. I know of several physicians and therapists who have wasted good money in the purchase of this volume only to read a few pages and then put the book in the shelf never to open it again. Being one of those so taken in, I hope no one else will make the same mistake.

—Lt. Col. J. N. Schaeffer, U. S. A. F. (MC)

# REPAIR OF CLEFT PALATE AND COLUMELLA WITH A TUBED SKIN PEDICLE<sup>(1)</sup>

JAMES CRAWFORD, *Commander, MC, U. S. N.*

CHARLES E. HORTON, *Lieutenant, junior grade, MC, U. S. N. R.*

RICHARD S. OAKLEY, *Lieutenant, MC, U. S. N. R.*

**T**HE cause, pathology, and treatment of harelip and cleft palate have been adequately presented by many authors and will not be included in this article. Although the employment of a tubed skin pedicle to close a cleft palate is not new (2-5), it is sufficiently rare to justify reporting the following case.

## CASE REPORT

A 40-year-old woman who was born with a bilateral cleft of the upper lip and a complete cleft of the hard and soft palate (fig. 1) was not operated on for correction of the cleft lip until she was 4 years old. No further operation was permitted by the parents of the patient, although at the age of 16 she was fitted with a prosthesis to cover the palatal defect. Three infantile teeth appeared on her premaxilla, but these teeth were soft and loose and she removed them with her fingers. No permanent teeth appeared on the premaxillary portion of her alveolar ridge. By 1948, when she was about 37 years old, her prosthesis had extensively worn away the enamel on the existing upper teeth and she was advised by a dentist to discontinue the use of the artificial plate.

In January 1948 she entered a hospital elsewhere for closure of the cleft palate. Apparently because of the width of the cleft, it was deemed inadvisable to use the routine type of mucoperiosteal flap repair. Therefore a tube was constructed on the left side of

(1) Plastic Surgery Service, U. S. Naval Hospital, National Naval Medical Center, Bethesda, Md.

(2) Blaü, V. P.: Operative treatment of difficult cases of palate defect after infancy. *Surg., Gynec. & Obst.* 12: 289, 1911.

(3) Pickerill, P.: Facial paralysis, palatal repair and some other plastic operations. *M. J. Australia* 1: 543, 1938.

(4) Padgett, E. C.: Repair of cleft palates after unsuccessful operations, with special reference to cases with extensive loss of palatal tissue. *Tr. Sect. Surg., General & Abd.*, A. M. A., pp. 336-358, 1929; also *Arch. Surg.*, 20: 453-472, Mar. 1930.

(5) Thiersch, C.: Verschluss eines Loches im harten Gaumen durch die Weichtheile der Wange. *Arch. d. prakt. Medik.* 9: 159-164, 1868.

her abdomen, transferred to her left wrist, and an attempt made to close her palate with this tube of skin, but after the tube was sutured to the edges of the palatal defect, infection occurred, and the distal one half of the pedicle was lost. In the process of constructing, delaying, skin grafting, and transferring the tubed pedicle 12 operations were performed.



Figure 1.

In October 1948, the remaining proximal half of the same tube was sutured on the mouth to close the palate, but the repair was lost when the pedicle was accidentally pulled loose while removing a Levin tube. This was the thirteenth operation in the attempt to close the palate. In November 1948, a second tubed pedicle was constructed on the right side of her abdomen and transferred to her right wrist, but the blood supply proved to be inadequate and this tube was lost. Twelve additional delaying and grafting operations were completed before the pedicle necrosed, making a total of 25 operations.

After the second pedicle was destroyed, construction of a third tubed pedicle was begun on her chest. In January 1950, before the third tube could be used, the patient's husband was transferred to another area and she reported to our hospital for further treatment. In the process of constructing the third tubed pedicle on her chest, 15 operations were required, making a total of 40 operations performed on the patient before admission to this hospital.

On admission to this hospital on 22 August 1950, physical examination revealed bilateral healed scars and an irregular mucocutaneous junction of the upper lip (fig. 2). The upper lip was small and was posterior in position and relationship to the nose and lower lip (fig. 3). Both alae nasi were wide and flaring, and



Figure 3.



Figure 2.



Figure 7.

Figure 8.

was sutured to the dependent portion of the septum to form a columella of adequate length and width (fig. 5). This newly constructed columella required débridement of excess fat, which was done in October. Three weeks later her upper lip was pulled forward and attached surgically to the under surface of the recently formed columella. These operations resulted in an elevated nasal tip, a cosmetically acceptable columella, and an upper lip which was shifted forward and which appeared normal in position. Her oral and nasal cavities were completely separated anteriorly (figs. 6 and 7).

For the first time she was able to eat and drink without the passage of food and liquid into her nose. Her speech was greatly improved and only a slight nasal tone remained. A few hairs are growing on the skin pedicle forming the palate but the tissue has adapted to the new environment without complications. A minor revision of the nares nasi was accomplished in November and a prosthesis to replace her missing upper teeth was obtained. No further operation should be necessary and the patient is at last free of her deformity. A total of 51 operations were performed before this result was accomplished.

It is not implied that the treatment of this patient should be standard for similar cases; rather, the failure of many commonly used surgical procedures is shown.

#### BOOK REVIEWS

**Textbook of General Surgery**, by *Warren H. Cole*, M. D., F. A. C. S., Professor and Head of the Department of Surgery, University of Illinois College of Medicine; Chief Surgeon, Illinois Research and Educational Hospitals, Chicago, and *Robert Elman*, M. D., F. A. C. S., Professor of Clinical Surgery, Washington University School of Medicine; Assistant Surgeon, Barnes Hospital; Associate Surgeon, St. Louis Children's Hospital; Chief of Staff and Director of Surgical Service, H. G. Philips Hospital, St. Louis. Foreword by *Everts A. Graham*, M. D., F. A. C. S., 6th edition. 1,154 pages; illustrated. Appleton-Century-Crofts, Inc., New York City, N. Y., publishers, 1952.

This new edition succeeds in adding to the fundamental surgical principles and practices presented in the outstanding fifth edition. The format is essentially the same and has been designed primarily for the student who is interested in gaining a basic knowledge of surgical diseases, their pathogenesis, and treatment. In order to cover adequately such a wealth of material, only well established principles have been included and these of necessity have been treated concisely and in a simplified way. An

extensive bibliography, however, has been included. Major additions and revisions have been made in the presentation of chemotherapy, vascular surgery, endocrine diseases, thoracic and cardiac surgery, pre- and post-operative care, and massive gastrointestinal hemorrhage. The diagrams and photographs are plentiful and well chosen.

Nonoperative therapy is stressed with various surgical procedures mentioned but not described in detail because such information can better be presented in more specialized texts. The section on military surgery by Berry has been revised to include the changes that have developed from the most recent Korean experiences in organization, goals, and specific methods of transporting and treating patients. This portion of the book and those on intestinal obstruction, fractures, dislocations, and sprains are particularly well done. This book can be highly recommended to every physician who has any contact with the clinical practice of medicine. Although primarily designed for the student, the fact that each section is written by an expert in that field makes the book of value for all surgeons, whether recent graduates or experienced practitioners.

—*Capt. D. A. Baltz, MC, U. S. A.*

*Skin Therapeutics, Prescription and Preparation (Materia Medica Dermatologica)* by M. K. Polano, Head of the Dermatological Department, Municipal Hospital, the Hague (Netherlands) with an introduction by Clarence S. Livingood, Professor of Dermatology, the University of Texas, Galveston (Tex., U. S. A.). 276 pages. Elsevier Publishing Co., New York, N. Y., 1952. Price \$6.50.

Except for a short historical introduction and some general considerations on dermatotherapeutics, this entire volume is devoted to a description of basic materials and their use in prescriptions for topical dermatologic therapy. Emphasis is placed on the selection of a vehicle for the dermatosis to be treated that will be pharmaceutically correct after the active ingredients have been added to it. Numerous sample prescriptions are given illustrating the use of basic materials as vehicles and as components in compound vehicles. These are usually followed by suggested combinations with specific remedies for use in the various dermatoses. The chapter on emulsions is presented with unusual clarity. The last 100 pages of the book consists of tables giving comparative lists of dermatotherapeutic drugs mentioned in the American, British, Swiss, and Dutch official formularies, with supplemental tables listing Belgian, Danish, French, German, Italian, Spanish, and Swedish dermatotherapeutic drugs. This last feature renders the book useful on an international scale as a formulary for dermatologic preparations.

—*Col. R. M. Williams, MC, U. S. A.*

# MANAGEMENT OF CHEST INJURIES IN A MOBILE SURGICAL HOSPITAL

EDWARD E. ROCKEY, Major MC, U. S. A. R. (1)

THE treatment of most of the thoracic injuries seen in a mobile Army surgical hospital (MASH 8076 AU) in Korea was conservative in contrast to that of the thoracoabdominal wounds which always required operation. A classification of the lesions is an aid in appraising the diagnostic and therapeutic problems. The injuries may involve the chest wall, the contents of the chest, or both.

## CHEST WALL INJURIES

*Stab and missile wounds* of the chest need to be débrided, frequently under 1 percent procaine infiltration anesthesia. If there is a possibility of extension of the wound into the parietal pleura, it should be closed with interrupted No. 00 chromic catgut sutures up to the skin level.

*Fractured ribs* are evidenced by pain, mainly during the inspiratory phase of respiration. If roentgenograms of the chest confirm the diagnosis, the patients are treated by nerve block of the 2 intercostal nerves above and below the level of the fracture or fractures with 1 percent procaine.

*Injury to an intercostal vessel* causes a growing hematoma at the site of the chest wall wound and requires ligation of the torn blood vessel at the time of the débridement of the wound. In the area between the anterior and posterior axillary line of the chest wall where the vessels are located within a bony groove this cannot be done without resecting a segment of the rib.

*Injury to an internal mammary vessel* also causes a growing hematoma at the site of the chest wall wound near the sterno-chondral junction. The torn vessel is ligated at the time of the wound debridement.

## INJURIES OF THE CONTENTS OF THE CHEST

Injuries to the contents of the chest in which the chest wall is apparently intact result from dull impacts to the chest. Patients with such injuries show varied evidence of respiratory

(1) Third Field Hospital, Korea, at time of writing.

distress depending on the extent of the injury and show signs and symptoms of pneumothorax, hemothorax, or hemopneumothorax. As soon as the clinical diagnosis is confirmed by posteroanterior and lateral roentgenograms of the chest, the blood and/or air is aspirated. This is repeated on the same day or daily until full re-expansion of the lung is accomplished. Frequently as much as 1,000 cc. of blood is aspirated at one time.

The aspirations are performed under aseptic conditions. In cases of hemothorax, under 1 percent procaine infiltration anesthesia, the intrapleural blood is first carefully localized by the insertion of a 20-gage needle at about the eighth intercostal space and midaxillary line. If blood is not obtained, an attempt is made at the anterior and posterior axillary lines and at higher levels. After the proper localization, a needle (not larger than 17 gage) is inserted and with the help of a 3-way stopcock and a 30-cc. syringe, the pleural space is aspirated as completely as possible. Prior to the withdrawal of the aspirating needle, 400,000 units of penicillin and 0.5 gram of streptomycin are instilled into the pleural space. In patients with hemopneumothorax or pneumothorax following the aspiration of the blood, the pleural space is also deflated. Unless the collapse is localized, the most advantageous site for the insertion of the aspirating needle is the second intercostal space at the midclavicular line. When possible, manometric readings are recorded and the air is aspirated by attaching the tube of a suction machine to the aspirating needle. The suction normally is maintained for as long as 15 minutes, which often results in complete re-expansion of the lung. If this procedure fails and the increasing subcutaneous emphysema suggests a continued escape of air, a thoracotomy tube (No. 24) is inserted into the pleural space in a dependent position for underwater drainage.

#### COMBINATION OF CHEST WALL WOUNDS AND WOUNDS OF THE VISCERA

The combination of chest wall wounds and wounds of the viscera of the chest are stab wounds and penetrating or perforating missile wounds. These result in hemothorax, pneumothorax, hemopneumothorax, and conditions requiring open thoracotomies.

Pneumothorax and hemopneumothorax may be associated with wounds of the open (sucking) or closed (tension) type. Patients with hemothorax, closed pneumothorax, and hemopneumothorax are treated by repeated aspirations and débridement of the chest wall wounds. The open wounds of the chest are treated under general endotracheal anesthesia. The wound is débrided, a thoracotomy tube is inserted through the débrided wound, and the blood is aspirated from the pleural space. The wound is then closed while the lung is kept inflated and the temporarily inserted thora-

cotomy tube is removed simultaneously. Frequently this technic makes added pleural aspiration unnecessary.

In those sucking wounds of the chest in which depressed rib fractures are present, the irregular rib ends are resected and the pleural space is irrigated with saline solution. Frequently a thoracotomy tube is inserted into the pleural space for underwater drainage. The chest wall defect is closed in layers by the approximation of the soft tissues outside of the parietal pleura with interrupted No. 0 chromic sutures. Attempts at closure of pleural tears are frequently impossible and unnecessary.

Conditions requiring open thoracotomy or its modifications include: (1) active intrapleural bleeding, (2) mediastinal perforation with injury or suspected injury to mediastinal structures, (3) the presence of large intrapleural foreign bodies, (4) wounds of the large bronchi or of the intrathoracic part of the trachea, and (5) wounds of the heart.

*Active intrapleural bleeding* results from massive lung laceration with or without intercostal or internal mammary vessel injury. The patient frequently is in shock. From 1,000 to 1,500 cc. of blood may be aspirated without changing the roentgenographic findings. Even though the patient is given more blood than the amount which is aspirated from the pleural space the hemoglobin and hematocrit levels remain below normal. At times, several pleural aspirations and repeated roentgenograms are needed to reach a definite diagnosis of active bleeding. In patients with clinical and roentgenographic evidence of massive hemothorax (frequently with bleeding and sucking chest wall wounds) and who do not respond to preoperative shock management, open thoracotomy should be performed without delay on the basis of suspected injury to a large vessel.

*Mediastinal perforation* with resulting mediastinal emphysema or perforation of mediastinal structures is another indication for open thoracotomy. In addition to the signs and symptoms of hemo-pneumothorax, patients with this condition present evidence of marked subcutaneous emphysema, particularly over the area just above the manubrium sterni. They are in much greater respiratory distress than would be expected from the extent of the existing pulmonary collapse.

*Large intrapleural metallic foreign bodies* are removed if they are easily accessible from the site of the entrance wound. These procedures are considered to be modified thoracotomies and consist of débridement of the entrance wound and its enlargement to a size sufficient to allow the insertion of the operator's hand into the pleural space. The metallic foreign body and loose bony particles are removed and the pleural space is evacuated and irrigated

with saline solution. Frequently a thoracotomy tube is inserted into the pleural space in a dependent position for underwater drainage. The chest wall wound is closed in layers.

*Wounds of the large bronchi or intrathoracic part of the trachea* are absolute indications for open thoracotomy. Patients with these conditions present evidence of hemopneumothorax with rapidly progressive subcutaneous emphysema. Needle aspiration or tube thoracotomy fail to re-expand the lung and ease the respiratory distress.

*Wounds of the heart* are easy to recognize if they present the classical signs of tamponade. Usually patients with this condition are in profound shock and in great respiratory distress. The heart sounds are muffled. The pulse is weak and thready and the pulse pressure is lowered. The problem is more complex when signs of cardiac tamponade are not present and the general condition of the patient is fairly good. In those patients, the location of the chest wall wounds and the estimation of the missile tract is of great help in the evaluation of the condition. If missile wounds of the heart are suspected, exploratory thoracotomy should be performed. Pericardial aspiration relieves patients with signs of cardiac tamponade. The xiphocostal is safer than the intercostal route for aspiration. Under 1 percent procaine infiltration anesthesia, a 19-gage needle is inserted at the left xiphocostal junction. The needle is directed at from 15 to 20 degrees to the left and upward and advanced posteriorly until the pericardium is perforated and blood is obtained.

## OPERATIVE TECHNIC

Depending on the location and type of the injury, posterior, lateral, and anterior operative approaches are used for thoracotomy. The applicability of the anterior approach is emphasized. In this procedure, the skin incision extends from a point about 1 inch medial to the costochondral junction to the midaxillary line over the intercostal space at the desired level. This is frequently the third intercostal space in which case the third and fourth cartilages are divided. If added exposure is needed, the incision is extended downward at a right angle to its medial end and 1 or 2 additional cartilages are divided. The lung lacerations are debrided, the bleeding points controlled with No. 000 silk ligatures, severed bronchi are repaired or closed with No. 000 silk sutures, and the torn lung surfaces are approximated with No. 00 chromic mattress sutures. The visceral pleural edges are also approximated with No. 00 chromic catgut mattress sutures. Penetrating missile wounds of the lung are similarly treated except that frequently gel foam strips are placed into the tunnel of the bullet tract prior to the closure of the entrance and exit wounds. Bleeding intercostal and internal mammary arteries are ligated. In pa-

tients with mediastinal emphysema, the mediastinum is drained. Perforated mediastinal structures are repaired. Cardiac wounds are approximated with interrupted No. 00000 twisted silk sutures. Intracardiac metallic foreign bodies are removed only if they are easily accessible. Following any of those procedures, the pleural space is carefully irrigated with saline solution. Two thoracotomy tubes are placed in the pleural space, one in a dependent position and one in the upper part of the chest for underwater drainage. The operative wound is closed in layers.

### PREOPERATIVE AND POSTOPERATIVE CARE

Patients with chest wounds need to be evaluated as quickly as possible by careful inspection of the wounds, physical examination, and posteroanterior and lateral roentgenograms of the chest. Blood is given immediately to all such patients except those showing no evidence of appreciable blood loss. The tracheobronchial tree is kept as free as possible of blood and secretion by encouraging coughing and expectoration, bronchial catheterization, and, if needed, bronchoscopic suction. All the patients receive 1 gram of streptomycin and 1 million units of penicillin on admission, followed by 0.5 gram of streptomycin twice a day and 600,000 units of penicillin every 6 hours. This antibiotic regimen is maintained during their entire period of hospitalization. In the postoperative period, the patients perform breathing exercises which include guided deep breathing about 12 times each hour in addition to the use of a blow bottle. The patients with thoracotomy tubes have the benefit of frequent suction by a suction machine in addition to continuous underwater drainage. The thoracotomy tubes are removed within 48 hours except from patients with continued escape of air through the thoracotomy tube. In these patients, the tube is left in place as long as it is functioning. The patients are allowed up on the second and third postoperative day and evacuated in from 2 to 8 days.

### CASE REPORTS

*Case 1. Rupture of lung without chest wall injury.* A 25-year-old man collided with a telephone pole, injuring the left anterior surface of his chest. On admission, he complained of severe pain in his chest dyspnea. Examination revealed marked tenderness over the upper anterior chest wall on the left side. A roentgenogram of the chest showed a 60 percent collapse of the left lung. Aspiration of 1,400 cc. of air from the left pleural space made him comfortable. Two days later, at the time of his evacuation, the lung had fully re-expanded.

*Case 2. Injury to the chest wall and lung.* A 22-year-old man was admitted 9 hours after he sustained a penetrating shell-fragement wound of the right side of his chest resulting in hemothorax-

thorax. After 5 aspirations of blood and air, in 3 days he was evacuated. At that time he was asymptomatic and the lung was fully re-expanded.

*Case 3. Open wound of the chest.* A 21-year-old man sustained penetrating shell-fragment wounds of the left side of his chest and flank resulting in a sucking wound, a fragmented fracture of the seventh rib near the transverse process, and hemothorax. Under general endotracheal anesthesia, the wound was debrided; bony fragments were removed; the depressed uneven rib ends were resected; the pleural space was aspirated; a thoracotomy tube was inserted in a dependent position; and the wound was closed. Three days later, the thoracotomy tube was removed. Seven days following admission, the patient was evacuated with the lung fully re-expanded.

*Case 4. Intrapleural metallic foreign body.* A man sustained a penetrating shell-fragment wound of the right side of his chest. He was admitted 5½ hours after the injury with a sucking wound at about the seventh rib in the parascapular line. Roentgenograms showed evidence of hemothorax and a metallic foreign body which appeared to be in the pleural space. Under general endotracheal anesthesia, the entrance wound was debrided; the pleural tear was lengthened to 2½ inches; the foreign body was removed; and the pleural space was evacuated and irrigated. A thoracotomy tube was inserted in a dependent position and the wound was closed. Seven days later, at the time of his evacuation, the patient was asymptomatic, the wound healed, and the lung fully re-expanded.

*Case 5. Active bleeding.* A 19-year-old man sustained perforating bullet wounds of the left side of his chest. He was admitted in shock. The entrance wound was located at about the first rib at the midclavicular line and the exit wound at the seventh intercostal space in the parascapular line. Over the posterior chest wall, there was a rapidly growing hematoma the size of an infant's head and marked subcutaneous emphysema. A roentgenogram of the chest showed massive hemothorax. A large amount of bright red blood was aspirated from the stomach. Open thoracotomy was performed through the fourth intercostal space with the fourth, fifth, sixth, and seventh cartilages divided. Perforating bullet wounds of the upper and lower lobes of the left lung with the bullet tract extending from the apex of the upper lobe across the entire upper lobe to the apical segment of the lower lobe; fracture of the first rib anteriorly and the seventh and eighth ribs posteriorly near their transverse processes; and a tear of the seventh intercostal artery were found. The lung wounds were debrided; the bleeding points controlled with No. 000 silk ligatures;

the bullet tracts were cleaned with saline solution; and gel foam strips were inserted (4 into the upper and 2 into the lower lobe), and the entrance and exit wounds closed with No. 00 chromic mattress sutures. The torn intercostal artery was ligated. Blood from the pleural space was evacuated and the space was irrigated with saline solution. Two thoracotomy tubes were inserted into the pleural space and the wound was closed. The hematoma of the posterior chest wall was evacuated. The entrance and exit wounds of the chest wall were débrided and closed. The patient made an uneventful recovery and was evacuated on the sixth postoperative day. At that time he was asymptomatic and the lung was fully re-expanded. The roentgenogram showed only parenchymal clouding at the sites of the pulmonary wounds.

*Case 6. Persistent bronchial openings.* A young Colombian soldier sustained perforating bullet wounds of the right side of his chest. He was admitted in shock. The entrance wound was at about the fourth intercostal space at the posterior axillary line. The sucking exit wound was at the first intercostal space just mesial to the midaxillary line. A roentgenogram showed hemopneumothorax, fracture of the second, third, and fourth ribs, and metallic foreign bodies retained within the chest wall. After a 1,000-cc. blood transfusion, the wounds were débrided under general endotracheal anesthesia. The depressed irregular ends of the fractured ribs were resected; a torn axillary vein was repaired; 3 metallic foreign bodies were removed; a large amount of liquid and clotted blood was evacuated from the pleural space with the help of a tube temporarily inserted through the exit wound, followed by irrigation with saline solution and insertion of 2 thoracotomy tubes; and the wounds were closed. The 2 underwater-drainage tubes functioned well, but the patient became more and more dyspneic. On the next day a roentgenogram showed about 80 percent collapse of the right lung. At this time, open thoracotomy was performed through a posterolateral approach. About 1 cm. of the sixth, seventh, and eighth ribs was resected and the pleural space entered through the sixth intercostal space. A laceration of the upper lobe of the right lung, about  $3\frac{1}{2}$  inches long, was found extending from the lung surface to the hilum. Within the torn surfaces, there were numerous bronchial openings through which air was escaping freely. There was no active bleeding. The cut surfaces were débrided; the devitalized tissue was cut away; the bronchial openings were closed with No. 00 chromic mattress sutures; and the lung surfaces were approximated with No. 00 chromic interrupted sutures. The visceral pleural edges were approximated with No. 00 chromic mattress sutures. Seven days after the thoracotomy, the patient was evacuated in good general condition, his lung had re-expanded, and the wounds were clean and healing.

*Case 7. Injury to the aorta.* A young American soldier sustained multiple shell-fragment wounds of the left posterior portion of his chest. He was admitted in shock. He expectorated and vomited blood. He had a palm-sized, hissing, bleeding, soft tissue defect over the posterior chest wall, and marked subcutaneous emphysema. A roentgenogram showed clouding of the left side of the chest and depressed fractures of the seventh and eighth ribs posteriorly. The patient was given a 1,000-cc. blood transfusion prior to operation but his response was inadequate. His chest was entered through the sixth intercostal space. The lower lobe was indurated with blood, giving it the appearance of liver. A retained metallic foreign body was removed from this lobe. There was a bleeding opening over the upper mediastinal pleura. The pleura was opened at about the area of the active bleeding and the bleeding traced to the aorta at the level just below the arch. A metallic foreign body was partially covering a transverse tear of the aorta 1 cm. long at a point of its junction with an intercostal artery. The shell fragment was removed, and the bleeding controlled by approximating the tear with Allis' forceps. The tear was sutured with No. 00000 braided silk. At the conclusion of the repair, cardiac standstill occurred. The pericardium was opened. An intracardiac transfusion was given and cardiac massage was maintained for 30 minutes, but the patient died.

## DISCUSSION

Early re-establishment of as normal a cardiopulmonary function as possible gives gratifying results. This was well demonstrated by the dramatic improvement of the general condition of the patients with sucking wounds, even those following the temporary sealing of the chest wall defects. The value of conservative treatment of chest injuries is well established (2-6). Repeated and early aspiration is the procedure of choice in most patients with hemothorax or hemopneumothorax. Sucking wounds are treated under general endotracheal anesthesia. Under these conditions a complete evacuation of the pleural space, adequate re-expansion of the lung, and cleaning of the bronchial tree can be accomplished. Few of these patients need subsequent aspirations. The indication for open thoracotomy among battle casualties are few because bleeding from most pulmonary wounds becomes self-con-

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trolled end only a few of those with active bleeding from the lung, large vessel, or the heart reach the hospital alive. Perforation of the diaphragm or its likelihood is an indication for laparotomy rather than thoracotomy (7). An anterior approach for thoracotomy (6) is favored because this is the quickest way of entering the chest and it gives adequate exposure. A careful closure in layers assures good healing of these wounds.

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### BOOK REVIEWS

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**Normal Blood Pressure and Hypertension, New Definitions**, by *Arthur M. Master*, M. D., Cardiologist, The Mount Sinai Hospital, New York; and Associate Clinical Professor of Medicine, Columbia University, New York, *Charles I. Garfield*, M. D., Research Assistant in Cardiology, The Mount Sinai Hospital, New York, and *Max B. Walters*, M. D., F. R. C. P. (C.A.N.), Member, Heart Station, Vancouver General Hospital, Canada; Formerly Research Assistant in Cardiology, The Mount Sinai Hospital, New York. 144 pages; 36 illustrations. Lea & Febiger, Philadelphia, Pa., publisher, 1952. Price \$4.

This handbook on blood pressure, replete with historical background, discussion, and statistical data, attempts "to establish the true normal limits of the blood pressure." The normal limits proposed are the result of a statistical study of the blood pressures of 74,000 unselected, working people, ranging from 16 to 65 years of age.

The new range of normal blood pressure proposed by the authors is somewhat higher than those now commonly accepted and varies with age and sex. As an example, the stated range of normal systolic pressure of men from 20 to 25 years old is from 105 to 140, whereas the range in the same age group for women is stated to be from 100 to 130. The lower limit of hypertension for this age group is regarded to be 150 for men and 140 for women. In men from 50 to 55 years old the range of normal systolic pressure is stated to be from 110 to 160, whereas for women it is from 110 to 165. The lower limits of hypertension in this age group is regarded to be 175, for men and 180 for women. There is further variation to be considered for weight and physical condition.

The authors also make the plea to consider the proposed new limits of blood pressure merely as one factor in a whole picture, stating that blood pressure itself is only a symptom to be evalu-

ated in the presence or absence of associated and related clinical findings. Although acceptance of the proposed new standards will undoubtedly be somewhat slow, this effort is distinctly a step in the right direction and the proposals made could well be adapted to Armed Forces physical standards.

—*Col. C. L. Leedham, MC, U. S. A.*

*Rorschach's Test, III. Advances in Interpretation* by Samuel J. Beck, Ph. D., Institute for Psychosomatic and Psychiatric Research, Michael Reese Hospital, Chicago; Departments of Psychology, University of Chicago and Northwestern University. 381 pages. Grune & Stratton, Inc., New York, N. Y., publishers, 1952. Price \$5.50.

This volume is a challenging, stimulating, and thought-provoking continuation of the author's studies on Rorschach's test. It contains the fruit of 5 years of research carried on under grant from the National Institutes of Health, and provides what the title promises—advances in interpretation.

Seven Rorschach records on 4 patients, either in analysis or therapy, are presented in detail. These broadly cover the years of childhood, adolescence, and young adulthood with the Rorschach test material being generously supplemented by data from the social worker's and psychiatrist's files. The end result is a contribution to the literature which is well worth the reading by anyone whose work involves a psychotherapeutic relationship with patients.

The objective, scientific, and yet intuitively sensitive manner in which Dr. Beck approaches and treats the dynamic material which is revealed by this projective psychologic test, and the manner in which he appraises the test itself is refreshing. He notes at one point: "We do have a good test, one that uses a fixed set of stimuli, and that gives results useful to the clinic and to the practitioner. Within a range of error moderate for what it attempts, the test provides dependable diagnostic pictures and guide posts for treatment. The test and its claims are now being subjected to some hard thinking and experimental check --- I look for hypotheses and a logic that will advance a science of the whole human personality. Whether this will be with the Rorschach, or any other test, will not then matter. Meanwhile, and in absence of research more convincing toward refuting the validities that have emerged, there are still the ten Swiss ink blots."—*Commander W. R. Griswold, MC, U. S. N.*

# CONGENITAL ATRESIA OF THE SMALL INTESTINE

LOWELL R. STEELE, *Lieutenant Colonel, MC, U. S. A.* (1)

CONN L. MILBURN, Jr., *Colonel, MC, U. S. A.* (1)

**A**LTHOUGH congenital atresia of the small bowel occurs in only 1 of every 1,500 (2) to 20,000 (3) newborn infants, we must be constantly on guard to recognize its occurrence early, if the infant's life is to be saved.

**Etiology.** Intestinal obstruction in the newborn may result from either an intrinsic or an extrinsic lesion. An intrinsic obstruction is a defect in the continuity of the lumen of the bowel due to an intra-intestinal development error. Extrinsic obstruction is the occlusion of the lumen of the bowel by external pressures. Whether from intrinsic or from extrinsic cause, total intestinal obstruction produces the same clinical findings and the treatment and outcome are much the same.

Congenital intrinsic atresias of the small intestine are believed to be the result of an arrest in the embryologic development. Patten (4) stated that prior to the fifth week of fetal life, the intestine is a primitive tube with a lumen lined with epithelium. After the fifth week, the epithelium proliferates to an extent that the entire lumen of the small intestine becomes obliterated with epithelial concrections. Thus, at about the eighth week, the intestine becomes a solid cord without a lumen. Sometime later, probably between the eighth and twelfth weeks, the diameter and length of the intestine increases so that the epithelial overgrowths spread out producing a vacuolation effect. As the diameter of the intestine continues to grow, the vacuole spaces coalesce to re-establish the intestinal lumen. An arrest in development during the "solid" stage results either in atresia or stenosis. Other theories of causation are fetal peritonitis (5) and vascular changes (6).

(1) Letterman Army Hospital, San Francisco, Calif.

(2) Evans, C. H.: Atresias of gastrointestinal tract. Internat. Abstr. Surg. 92: 1-8, Jan. 1951.

(3) Webb, C. H., and Wangenstein, O. H.: Congenital intestinal atresia. Am. J. Dis. Child. 41: 262-284, Feb. 1931.

(4) Patten, B. M.: Human Embryology. The Blakiston Co., Philadelphia, Pa., 1946.

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**Pathology.** Atresia of the small intestine is single in 85 percent of cases and multiple in the remaining 15 percent (3). The lesion may be in the form of a single veil or diaphragm that blocks the lumen, but this type is the least common. The other form of atresia represents a congenital aplasia of a segment of bowel, the intestine ending in a blind sac. In some cases, the segments of bowel may be connected by a fibrous band (7). With atresia the proximal portion of the bowel is greatly distended with gas and fluid (4 to 6 cm. in diameter) and the distal portion is collapsed (about 0.5 cm. in diameter). Due to the intraluminal pressure in the distended proximal portion, the walls become ischemic and necrotic. Ladd and Gross (8) stated that there is always danger of perforation after the third day of life in patients who are not operated on. The most common sites of atresia of the small bowel are (1) the ileum and (2) the duodenum. Of 47 patients observed by Ladd and Gross, 38 were in the ileum, 5 in the duodenum, and 6 in the jejunum. Davis and Poynter (9) collected 286 cases. Of these, the atresia was in the ileum and jejunum in 181 and in the duodenum in 134. Tandler (10) found in his series of 88 cases that the obstruction was in the ileum and jejunum in 55 and in the duodenum in 33.

**Prognosis.** Miller (11) pointed out that prior to 1911, there were no reported cases of survival from this condition. In that year, Fockens (12) reported the first successful treatment following lateral intestinal anastomosis. Survival remained rare until recent years. Potts (13) stated that 20 years ago, a post-operative recovery was of sufficient rarity to be worthy of publication. Of the 47 patients operated on by Ladd and Gross (8) only 7 recovered. Today the mortality figures are constantly improving because of earlier diagnosis, chemotherapy and antibiotics, improved surgical techniques, and better preoperative and postoperative management. The following is a case reported, not because of its rarity, but for the purpose of re-emphasizing the importance of the 4 cardinal factors in the successful treatment of such patients; namely, early diagnosis, preoperative care, prompt surgical treatment, and postoperative care.

(7) Aszkenasy, E. E.: Surgery of newborn. *J. Mt. Sinai Hosp.*, 17: 528-531, Mar.-Apr. 1951.  
(8) Ladd, E. E., and Gross, R. E.: *Abdominal Surgery of Infancy and Childhood*. F. A. Saunders Co., Philadelphia, Pa., 1941.

(9) Davis, D. L., and Poynter, C. E. M.: Congenital occlusions of intestines; with report of case of multiple stenosis of jejunum. *Surg., Gynec. & Obst.* 34: 35-41, Jan. 1922.  
(10) Tandler, J.: Zur Entwicklungsgeschichte des Menschen-Duod. Ia frühe Embryonalstadien. *Morph. Jahrb.* 29: 187, 1902.

(11) Miller, E. M.: Bowel obstruction in newborn. *Ann. Surg.* 110: 587-605, Oct. 1939.  
(12) Fockens, P.: *Zentralbl. f. chir.* 38: 532, 1911.

(13) Potts, W. J.: Congenital stenosis of intestine and colon. *Surg., Gynec. & Obst.* 53: 14-19, July 1947.

## CASE REPORT

A 5-day-old girl was transferred to this hospital from an out-lying hospital on 4 December 1951 with symptoms of intestinal obstruction. She had appeared normal at birth, but 3 or 4 hours later she began to regurgitate small amounts of clear fluid. The oral feedings given during the first 4 days of life were also regurgitated, the color of the vomitus becoming green brown. She had passed only a small amount of thin, yellow-green stool. Her fluid intake had been maintained by parenteral fluids.

On admission to this hospital she appeared remarkably well. Because she had received parenteral fluids, her hydration was good, and there were no findings indicating electrolyte or acid-base imbalance. Her abdomen was moderately distended and tympanic. No bowel sounds were noted by auscultation. No meconium was present in the rectum. Her erythrocyte count was 5,020,000; her hemoglobin was 14.1; her leukocyte count was 12,550 with 45 percent neutrophils, 25 percent lymphocytes, 26 percent monocytes, 3 percent eosinophils, and 1 percent basophils; her nonprotein nitrogen was 38 mg. per 100 cc.; her chlorides were 110 milliequivalents per liter; her sodium was 143 milliequivalents per liter; and her carbon dioxide combining power was 17.5 milliequivalents per liter. A roentgenogram of the abdomen and a barium enema (figs. 1 and 2) revealed an obstruction of the small intestine, probably in the lower jejunum or upper ileum.

Preoperative measures designed to put the infant in optimum condition included decompression of the stomach and the administration of parenteral fluids and whole blood, penicillin, streptomycin, and vitamin K. Twenty-four hours after admission, the infant's condition was considered to be excellent, and she was taken to the operating room.

The peritoneal cavity was opened through a right rectus incision under open drop ether anesthesia. Exploration revealed that the duodenum and the proximal two-thirds of the jejunum were distended to 3 or 4 cm. in diameter. At about the junction of the middle and lower thirds of the jejunum, the bowel terminated in a blind pouch. At this point there was complete interruption of the jejunum and its attached mesentery, representing congenital segmental aplasia. The small intestine distal to this point was found to be collapsed and measured from 0.5 to 1 cm. in diameter. It was completely unattached to the proximal bowel (fig. 3). Saline solution was injected into the lumen of the distal segment of bowel through a small caliber needle, and the patency of this portion of the intestine was determined by observing the



Figure 1. Radiogram showing dilated stomach and multiple segments of distended bowel. Figure 2. Radiogram showing small large bowel with reflex into ileum and distended segments of small bowel.

passage of the fluid into the lower colon. A side-to-sido anastomosis of the jejunum was completed using the technic recommended by Lind and Gross (8) (fig. 3).



Figure 3. Diagram showing findings at operation. Note interruption of the small bowel continuity by complete absence of bowel and mesentery. The duodenum and proximal 2/3 of jejunum are distended and the distal 1/3 of jejunum and ileum are collapsed. Insert shows side-to-side anastomosis of jejunum.

Postoperatively, penicillin and streptomycin were given intramuscularly. Continuous gastric suction was maintained for the first 48 hours without oral feedings. Fluids, electrolytes, and whole blood were administered through an ankle vein. When the passage of small meconium stools occurred at the end of the second postoperative day, accompanied by vigorous peristalsis, the gastric tube was removed. Small oral feedings of glucose water were started. Although the infant's clinical appearance continued to be good, a mild degree of partial intestinal obstruction persisted for about 10 days. This was indicated by occa-

sional regurgitations of oral feedings and some hyperperistalsis. In addition, a roentgenogram of the abdomen revealed some dilated loops of bowel. This partial obstruction was believed to be due to edema in and about the anastomosis in the jejunum. On the sixteenth postoperative day, just prior to discharge, a roentgenogram of the abdomen revealed no distended loops of bowel. The infant was then taking full-strength milk formula feedings and she was gaining weight daily. Three or four normal stools were passed each day. Blood chemistry determinations continued to be within normal limits. She was discharged from the hospital in good condition on the nineteenth postoperative day.

### FACTORS IN SUCCESSFUL TREATMENT

*Early diagnosis* soon after birth is essential for a favorable prognosis in any of these patients. If the diagnosis is not made in the first few days of life, those infants die of severe dehydration and electrolyte imbalance and/or from generalized peritonitis following rupture of the distended upper bowel. The diagnosis is based on the clinical and roentgenologic findings.

Congenital atresia of the small bowel should always be suspected when the tetrad of vomiting, abdominal distention, gastric waves and/or intestinal patterning, and small scanty mucoid stools is observed soon after the first feeding in the first day of life. The suspicion should be confirmed by roentgenologic studies.

Vomiting is the first and most important symptom calling attention to the condition. The time of its appearance depends on the site of obstruction. High obstruction in the duodenum and upper jejunum causes vomiting during or within a short time after the first feeding. Lower obstruction may not produce vomiting for a longer period of time and often not until after several feedings have been given. Once vomiting begins, it continues almost constantly. Except in rare patients in whom the atresia is above the ampulla of Vater, the vomitus is always bile-stained, of a fluid character in high obstructions, and malodorous with a fecal character in lower obstructions.

Abdominal distention develops soon after birth. It is confined to the upper abdomen in high, but is generalized in the lower obstructions.

Peristaltic waves are present at birth and persist until later when an adynamic ileus may occur. In duodenal and high jejunal atresias, gastric waves from left to right may be seen. In those lower in the intestine, intestinal patterning is seen.

Instead of normal shiny dark green meconium being passed, only small, faintly green mucoid stools are noted. The use of

Farber's test (14) is of aid in proving the existence of complete intestinal obstruction. The absence of cornified epithelial cells of the vernix caseosa in stained smears of stools signifies complete obstruction.

Roentgenologic studies of each patient should be made for confirmation and determination of the location of the obstruction. The presence of clinical findings with evidence of distended loops of bowel on plain roentgenograms of the abdomen indicates obstruction. Even when these fail to locate the site of obstruction, surgical exploration usually should be immediately carried out without resort to roentgenographic studies with contrast media. The use of the latter, though it will localize the site of the obstruction, is dangerous because the barium may become obstructive, and more important, swallowed barium may be regurgitated and then aspirated into the lungs. In most patients plain roentgenograms suffice to localize the obstruction. They should be taken with the patient in the upright position. Typically, duodenal or high jejunal obstructions are indicated by a greatly dilated stomach and a duodenum almost equally large; jejunal obstructions by several distended loops of small bowel; and ileal obstructions by multiple dilated loops throughout the abdomen. Barium enema is often useful in demonstrating whether the site of the obstruction is in the small or large intestine.

*Preoperative care.* Optimum condition must be attained for each patient prior to operation in order to minimize the operative risk, but this preparatory period must not be too long as an operation is indicated as early as possible.

Infants with atresia of the bowel present some degree of dehydration and prerenal uremia secondary to oligemia and poor circulation. Several types of electrolyte and acid-base imbalance may be present, depending on the site of obstruction. Patients with high obstructions have a hypokalemic, hypochloremic alkalosis, possibly associated with hypocalcemic tetany. The predominant loss of chlorides in the vomitus produces bicarbonate excess and metabolic alkalosis. The latter depresses the blood ionized calcium with ensuing tetany. Patients with lower obstructions have a hypokalemic, relative hyperchloremic acidosis. The predominant loss of the alkaline intestinal secretions produces a bicarbonate deficit with relative chloride excess and metabolic acidosis.

Probably the most important alteration in blood electrolytes is the loss of potassium. A low blood potassium occurs in all obstructions, whether high or low, producing a serious effect on the

(14) Farber, S.: Congenital atresia of alimentary tract; diagnosis by microscopic examination of meconium. J. A. M. A. 100: 1753-1754, June 3, 1933.

neuromuscular system and the heart. Attention must be paid to potassium balance in these infants by obtaining periodic blood chemistry determinations and ECG's.

In the work-up of these patients blood chemistry determinations, a blood count, crossmatching of blood for transfusion, and a urinalysis should be obtained immediately. Appropriate wide spectrum antibiotics are given parenterally. Determinations of the sodium, potassium, chlorides, nonprotein nitrogen levels of the serum, and the carbon dioxide combining power are essential to the formulation of proper solutions for parenteral administration. A polyethylene tube is inserted into an ankle vein exposed through a skin incision for use as a route of continuous intravenous administration of fluid during the preoperative, operative, and postoperative stages. Total daily amounts of fluids to be given are estimated on the basis of 150 cc. per kilogram of body weight, with an additional 100 cc. per kilogram of body weight when clinical evidence of dehydration is present. As there is almost always a renal shutdown, it is good procedure to give 10 percent dextrose in water while awaiting the reports of the emergency blood chemistry determinations. This promotes the return of renal function. When the laboratory reports are received, the indicated types and amounts of fluid are given. Whole blood transfusions, using 10 cc. per pound of body weight, are given when indicated.

The stomach is emptied and washed through a catheter which is left in place during the operation and is used postoperatively for attachment to a Wangensteen suction apparatus. When dehydration, shock, and electrolyte and acid-base imbalances have been corrected, the infant is taken to surgery.

*Surgical technic.* The diagnostic considerations and surgical treatment of these newborns differ from those employed in older children. Some of the techniques which are useful in the older age groups may actually increase the mortality if employed during this period of life (15).

Although local anesthesia may be used, open drop ether with a mask gives better relaxation and exposure. The surgical treatment of an obstruction due to congenital atresia is the establishment of a side-to-side anastomosis between the parts of the intestinal tract immediately above and below the site of the obstruction (7). It is essential that the surgeon establish the fact that the lower segment of bowel is patent and not obstructed by other areas of atresia. A simple procedure for determining the continuity and patency of the lower segment of bowel is to inject

(15) Weiser, L. R., and Richmond, J. B.: Diagnosis of surgical conditions of newborn infant. *J. Pediat.* 36: 107-121, Jan. 1950.

normal saline solution into the lumen by the use of a fine needle and then watch the fluid pass into the lower colon.

The open type of anastomosis without the use of clamps is recommended. Two layers of sutures are preferred for the anastomosis using No. 0000 catgut for the inner layer and fine silk for the serosal layer; but if 2 rows of sutures tend to compromise the lumen of the bowel, a single layer of fine chromic catgut is sufficient (8). The tissues are delicate and require the utmost care in handling to avoid injury that would nullify the results.

When the proximal portion of bowel has become gangrenous or has perforated, it must be resected before the anastomosis is performed. With the site of atresia above the ampulla of Vater, a gastrojejunostomy is the procedure of choice. For duodenal atresias below the ampulla of Vater, a duodenojejunostomy is the recommended procedure. For all other atresias of the small intestine a side-to-side anastomosis is preferred (8).

Ileostomy or enterostomy alone leads to a severe loss of fluid followed by marked dehydration that cannot be controlled by the intravenous administration of fluids. Surgeons who have had a great deal of experience with this procedure do not believe that it offers any hope of clinical improvement but may aggravate the condition.

*Postoperative care.* Penicillin and streptomycin are injected intramuscularly every day for the prevention of infection. Constant gastric suction is performed through a gastric catheter by the use of a Wengensteen apparatus. Appropriate fluids and whole blood are given by continuous drip in the ankle vein, paying particular attention to potassium balance.

The manipulation of the bowel at operation always produces some adynamic ileus for from 24 hours to several days. The return of peristalsis is indicated by passage of stools and/or flatus and bowel sounds heard by auscultation. When peristalsis is believed to have returned, the catheter is removed from the stomach and oral feedings are started. Small amounts (from 4 to 8 cc.) of glucose water every 3 hours are given at first. If no vomiting occurs, a weak milk formula is substituted. When all feedings are retained, the amounts are gradually increased until the baby is taking the usual formula. Postoperative roentgenograms of the abdomen should be obtained periodically for confirmation that the obstruction has been corrected.

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of the pyrazines of which pyrazinamido appeared to possess the most activity (3). In tuberculous infections of mice, pyrazinamido proved to have a therapeutic index of 500 and to be 7 times as active by weight as nicotinamide and several times as active as PAS. In more than half of the patients studied, the tubercle bacilli were either reduced or eliminated from the sputum, but there was a rapid emergence of highly resistant organisms in those with far advanced disease and cavitation.

The early clinical and limited laboratory studies with isonicotinic acid hydrazide (isoniazid) and its isopropyl derivative (IPH) were encouraging (4-22). Unfortunately, the first reports were released to the public without sufficient experimental data concerning susceptibility of human strains of *Mycobacterium tuberculosis*.

(3) Malone, L.; Schatz, A.; Lindb, H.; McKeenie, D.; Kiser, J. S.; and Williams, J. H.: Effect of pyrazinamide (aldinamide) on experimental tuberculosis in mice. Am. Rev. Tuber., 65: 511-518, May 1952.

(4) Zieper, L., and Lewis, R. A.: Tuberculosis in Macacus rhesus treated with isonicotinylhydrazine. Quart. Bull., Sea View Hosp. 13: 12-16, Jan. 1952.

(5) Grunberg, E., and Scheitzen, R. J.: Studies on activity of hydrazine derivatives of isonicotinic acid in experimental tuberculosis of mice. Quart. Bull., Sea View Hosp. 13: 3-11, Jan. 1952.

(6) Selikoff, L. J.; Robitzek, E. H.; and Orenstein, G. G.: Toxicity of hydrazine derivatives of isonicotinic acid in chemotherapy of human tuberculosis; preliminary report. Quart. Bull., Sea View Hosp. 13: 17-26, Jan. 1952.

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(8) Doaworth, D. M., Wright, H. A., and Fielding, J. T.: Marsilid in treatment of tuberculous orthopedic lesions; preliminary report. Quart. Bull., Sea View Hosp. 13: 52-73, Jan. 1952.

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(11) Editorial: New antituberculosis drugs. J. A. M. A. 149: 1034-1035, Mar. 22, 1952.

(12) Grunberg, E.; Lewinsohn, B.; D'Ascello, I. L., and Schatz, R. J.: On lasting protective effect of hydrazine derivatives of isonicotinic acid in experimental tuberculosis infection of mice. Dis. Chest 21: 369-377, Apr. 1952.

(13) Grunberg, E., and Schatz, R. J.: Effects of hydrazine derivatives of isonicotinic acid on infection of mice with *M. tuberculosis* var. bovis. Yale J. Biol. & Med. 24: 357-365, Apr. 1952.

(14) Bernstein, J.; Lou, T. A.; Steinberg, B. A., and Yule, H. L.: Chemotherapy of experimental tuberculosis. V. Isonicotinic acid hydrazide (pyridosulfone) and related compounds. Am. Rev. Tuber., 65: 357-364, Apr. 1952.

(15) Lewis, R. A., and Zieper, L.: Tolerance of Macacus rhesus for isonicotinylhydrazines; preliminary report. Dis. Chest 21: 378-384, Apr. 1952.

(16) Steenken, W., Jr., and Tolnay, E.: Antituberculous properties of hydrazides of isonicotinic acid (rimulos, marsilid). Am. Rev. Tuber., 65: 365-373, Apr. 1952.

(17) Editorial: Isonicotinic acid hydrazide. Lancet 1: 702-703, Apr. 1952.

(18) Robitzek, E. H., and Selikoff, L. J.: Hydrazine derivatives of isonicotinic acid (rimulos, marsilid) in treatment of active progressive extrapulmonary tuberculosis; preliminary report. Am. Rev. Tuber., 65: 402-428, Apr. 1952.

(19) Selikoff, L. J., and Robitzek, E. H.: Tuberculosis chemotherapy with hydrazine derivatives of isonicotinic acid. Dis. Chest 21: 385-438, Apr. 1952.

tuberculosis to these agents. Preliminary studies have shown the effective tuberculostatic properties of isoniazid and IPH against the H37Rv strain.

The recent observations of Steeaken et al. (23, 24) demonstrated the in vivo development of resistance of *Myco. tuberculosis* to isoniazid in 4 of 6 patients with chronic cavitation. Karlson and Ikemi (25) showed that in 15 of 17 humaa strains of *Myco. tuberculosis* and 7 bovine strains of *Myco. tuberculosis*, resistance to isoniazid was developed 16 fold after 4 transfers of the organism on egg yolk agar containing the drug. Eleven colonies selected from gradieat plates were resistant to isoniazid ia "concentrations greatly in excess of those required to inhibit the great majority of tubercle bacilli in the origiaal iaoculum." Hobby and Lenert (26) aoted that ia a given populatioa of *Myco. tuberculosis*, cells resistant to isoniazid were fouad ia significant aumbers. Syzbalski and Brysoa (27) have reported that resistance to isoniazid was a "one step" resistance. This is comparable to the developmeat of resistaace to streptomycia as opposed to the step-wise development of resistance of bacteria to penicillin and the broad spectrum aantibiotics. Pansy et al. (28) showed that the isoniazid resistance of BCG develops rapidly aad is lost on serial subculture. Studies ia this laboratory (29) have coconfirmed the foregoing and have shown that 13 of 15 humaa strains of *Myco. tuberculosis* which were considered sensitive

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(23) Steenken, W., Jr.; Meade, G. M.; Wolinsky, E.; and Coates, E. O., Jr.: Demonstration of increased drug resistance of tubercle bacilli from patients treated with hydrazides. Am. Rev. Tuberc. 65: 754-758, May 1952.

M.; Wolinsky, E.; and Coates, E. O., Jr.: Drug resistance of tubercle bacilli treated with isonicotinic acid hydrazides. (Correspondence) J. A. M. A. 149: 187, May 10, 1952.

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(26) Hobby, G. L., and Leavett, T. F.: Resistance to isonicotinic acid hydrazide. Am. Rev. Tuberc. 65: 771-774, May 1952.

(27) Szybalski, W., and Bryson, V.: Bacterial resistance studies with derivatives of isonicotinic acid. Am. Rev. Tuberc. 65: 768-770, May 1952.

(28) Pansy, F.; Stander, H., and Dosovick, R.: In vitro studies on isonicotinic acid hydrazide. Am. Rev. Tuberc. 65: 761-764, May 1952.

(29) Fusillo, M. H.; Wagner, B. M.; and Kubns, D. M.: Relationship of streptomycin sensitivity of *M. tuberculosis* to action of derivatives of isonicotinic acid. To be published.

to streptomycin were resistant to isoniazid and IPH. A study of 29 organisms of varying degrees of resistance to streptomycin indicated no relationship between resistance to isoniazid and streptomycin.

Middlebrook (30) using Valleo bovino and R1Rv strains of *Myco. tuberculosis* detected naturally occurring resistant variants of the organisms to isoniazid. In addition, he re-emphasized that the selection of variants of tubercle bacilli resistant to chemotherapeutic agents can possibly be inhibited by simultaneous exposure of these organisms to drugs whose modes of action differ. Syzbalski and Bryson (27) reported that combinations of IPH, and streptomycin, neomycin, viomycin, Pas, or thiosemicarbazone against the tubercle bacilli were purely additive, and Ilavsky (31) reported a synergistic action between isoniazid and streptomycin.

## DISCUSSION

The problem of the streptomycin resistance of *Myco. tuberculosis* is well documented. Resistance based on natural selection appears to account for the "one step" pattern noted *in vitro* and *in vivo*. This means that the temporal relationship of drug to bacteria is critical concerning the rate of emergence of resistant forms. Thus a relatively constant number of highly resistant cells may be isolated at one time over a wide range of concentration of the drug. PAS has been shown to delay the development of resistance to streptomycin, but in time the tubercle bacilli became resistant. In a similar manner, the organisms may develop PAS resistance.

It was not entirely unexpected to find naturally occurring strains of *Myco. tuberculosis* resistant to the derivatives of the isonicotinic acid hydrazides. Resistance to these compounds is apparently independent and in no way correlates with susceptibility of the tubercle bacilli to other agents. The clinician cannot assume that a streptomycin-sensitive strain is also isoniazid-sensitive or that the converse is true. For this reason before therapy is instituted the degree of susceptibility should be determined by standardized *in vitro* tests. Workers in this field acknowledge the limitations of the tests used to determine the sensitivity of *Myco. tuberculosis*. They serve, however, as a guide to the clinician for effective therapy.

(30) Middlebrook, G.: Sterilization of tubercle bacilli by isonicotinic acid hydrazide and incidence of variants resistant to drug *in vitro*. Am. Rev. Tuber. 63: 765-767, May 1952.

(31) Ilavsky, J.: Synergistic action of isonicotinic acid hydrazide and streptomycin *in vitro*. Am. Rev. Tuber. 63: 776-778, May 1952.

## CONCLUSIONS

Tubercle bacilli develop resistance to streptomycin and the derivatives of the isonicotinic acid hydrazides in a characteristic "one step" pattern covering a wide range of drug concentration. There is no relationship between the susceptibility of *Mycobacterium tuberculosis* to streptomycin or to PAS and derivatives of isonicotinic acid. The synergistic and/or additive effect of isoniazid has not been completely evaluated. *In vitro* laboratory susceptibility tests are essential as a guide to rational therapy.

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## BOOK REVIEWS

**Problems of Aging**, Transactions of the Fourteenth Conference, September 7-8, 1951, St. Louis, Mo., edited by Nathan W. Shock, Chief, Section on Gerontology, National Heart Institute, National Institutes of Health and the Baltimore City Hospitals, Baltimore, Md. Sponsored by the Josiah Macy, Jr. Foundation. 138 pages; illustrated. Printed by Progress Associates, Inc., Caldwell, N. J., 1952. Price \$3.

In this compilation, the knowledge of various scientific disciplines is applied to the problems of aging. The authors have attempted to elicit provocative discussions of the difficulties which are being encountered in research and practice.

The book is divided into 4 sections: (1) Biology and Medicine, introduced by John Esben Kirk; (2) Sociology, Psychology, Education and Religion, introduced by Robert J. Havighurst; (3) Economics, Employment and Welfare, with a statement of the problem by Wilbur J. Cohen; and (4) Medical Services, Hygiene and Housing, introduced by the late Joseph W. Mountin. This approach to the problem of aging is of interest to the physician. There is no index and the references are of little value to the medical practitioner. The approach is unusual, but this publication does not add particularly to the accumulated knowledge on the subject.—Commander T. D. Cuttle, MC, U. S. N.

**Principles and Practice of Anesthesiology**, by Vincent J. Collins, M. D., Director of the Department of Anesthesiology at St. Vincent's Hospital of the City of New York. 528 pages; 99 illustrations. Lea & Febiger, Philadelphia, Pa., publisher, 1952. Price \$10.

The author has produced a text covering all the phases of anesthesiology rather than a reference book on one small segment of the field. The need for such a book has been evident for some time to those engaged in teaching, whether it be undergraduate students or residents. This volume will be of greatest value to the student and part-time anesthesiologist. As in any book of this kind,

there are personal opinions with which any one reviewer would disagree, but there is relatively little material presented that would not receive universal acceptance. A noteworthy feature is the excellent bibliography at the conclusion of each chapter.

—*Lt. Col. E. P. Shannon, Jr., MC, U. S. A.*

*Essentials of Dermatology*, by Norman Tobias, M. D., Associate Clinical Professor of Dermatology, St. Louis University; Assistant Dermatologist, Fitzsimons DeLoge and St. Mary's Hospitals, Visiting Dermatologist, St. Louis State Hospital; Fellow, American Academy of Dermatology and Syphilology, Diplomate, American Board of Dermatology and Syphilology; Visiting Physician in the Department of Dermatology at the St. Louis City Hospital. 4th edition. 596 pages, illustrated. J. B. Lippincott Co., Philadelphia, Pa., publisher, 1952.

This text has been prepared specifically for the general practitioner and the student. As such it is a very good reference for the many dermatologic conditions certain to have been unheard of by both categories of nonspecialist. As an introduction to the subject, each topical discussion is considered to be adequate, and not too verbose. It does not depress the beginner, as do more extensive texts, with a plethora of complicated prescriptions. Many eponyms are mentioned, a distinct aid to the neophyte, unfamiliar with this trick of the specialist.

The sections on nursing care appear for the most part to be directions for the office nurse to prepare the accoutrements for physical examination and therapy. Little in the way of specific nursing directions is given.

From the dermatologic viewpoint, the histopathology is not sufficiently detailed for the student, who as a specialist must depend on his own diagnosis, if he expects more aid from his biopsy than the usual, "chronic dermatitis," furnished by the general pathologist. I object to the definition of dermatology as a branch of internal medicine. The specialty is concerned with many fields, such as histopathology, radiation, physical therapy, and pharmacology.—*Capt. C. D. Bell, MC, U. S. N.*

## BOOK REVIEWS

*Viral and Rickettsial Infections of Man*, edited by Thomas M. Rivers, M. D., Director of the Hospital, The Rockefeller Institute for Medical Research. 2d edition. 719 pages, illustrated. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1952.

This new edition has been enlarged, revised, pruned, brought up to date, and made more clinically useful than its predecessor. It meets a distinct need in the modern medical library and should be available for medical students, medical practitioners, public health and laboratory workers, and members of the military medical services, so that the information contained therein is readily accessible. It is not designed for the advanced worker with viruses and rickettsia. It carefully surveys the basic facts of the rapidly growing field of knowledge in this complex field. The expert organization of the book, the careful selection of material, the general clarity of style, the excellent documentation, both in chapter references and complete bibliographic and subject indexes, and the excellent illustrations, tables, and charts, make the volume easy to use.

Clinical material, including sections on epidemiology and control measures, is included throughout the book. The new chapter on the difficult subject of the diagnosis of viral and rickettsial infections should be of great value to the clinician. Other new chapters deal with human infections produced by the recently discovered Coxsackie viruses, viral hemagglutinins, and interference between animal viruses.

—Lt. Col. W. R. deForest, MC, U. S. A.

*Veterans Administration Technical Bulletins, Series 10, Volume V, 1951.*  
TB 10-71 through TB 10-81; illustrated. Veterans Administration, Washington, D. C., publisher, January 1952. Printed at Government Printing Office, Washington, D. C., 1952.

This book consists of 11 short monographs, each written by outstanding authorities: (1) "Parenteral Protein Nutrition" by Revlin and Gimbel; (2) "Fever of Obscure Origin" by Beeson; (3) "Sarcoidosis" by Longsden; (4) "The Diseases of Collagen" by Baehr and Lovitt; (5) "Cancer and Other Tumors of the Stomach" by North; (6) "Acute and Chronic Barbiturate Intoxication" by Isbell; (7) "The Management of Peptic Ulcer" by Ruffin; (8) "The

Differential Diagnosis of Vertigo" by Lindsay; (9) "Differential Diagnosis and Management of Pyogenic Meningitis" by Daniels and MacMurray; (10) "The Surgical Treatment of Cardiovascular Disease" by Hanlon; and (11) "The Management of Gastrointestinal Hemorrhage" by Elsom. These technical bulletins accurately and adequately cover all the essential points of interest to practicing clinicians. The method of presenting the material is almost identical with that used in the Department of the Army Technical Bulletins. This volume would be a valuable addition to any medical library or to that of any clinician interested in the subjects covered.—*Col. W. C. Berry, MC, U. S. A.*

*Principles, Problems, and Practices of Anesthesia for Thoracic Surgery*, by Henry K. Beecher, M. D., Henry Isaiab Dorr Professor of Research in Anesthesia, Harvard University; Director, Department of Anesthesia, Massachusetts General Hospital, Boston, Mass. American Lecture Series Publication No. 139. A Monograph in American Lectures in Anesthesia. 65 pages. Charles C Thomas, Publisher, Springfield, Ill., 1952. Price \$2.50.

This monograph for the practicing anesthesiologists is written in outline form with many subheadings. The major headings and divisions are somewhat confusing. The context, however, is explicit and the language is easily understood. Although almost half the book is devoted to the lobectomy-pneumonectomy group, very little new material is presented in this section. The author includes the generally known objectives concerning tracheobronchial secretions. The physical laws involved in coughing are reviewed and treatment to prevent troublesome coughing is discussed. Under the heading "Anoxia," positive pressure respiration is explained and the dangers are pointed out. Many of the finer points of positive pressure oxygenation are described and explained. Timely warnings are set forth and the physiologic basis for them is given.

The chapter entitled "Elevation of the Arterial Carbon Dioxide Tension" relates hypotensive states to increased alveolar CO<sub>2</sub> concentration quite well. Many questions are raised by the author as to the cause and possible remedy but they are left unanswered. In the circulatory section some excellent work has been done to correlate intrabronchial pressure with sudden and otherwise inexplicable drops in blood pressure. There is a notable lack of mention of apneic technics which are used by many anesthesiologists. The discussion of the maintenance of the circulating blood volume is not especially informative but points out some of the well-known phenomena that occur in relation to blood transfusions.

The discussion of the use of intratracheal tubes and inflatable cuffs in anesthesia for thoracic operations is excellent, but

there is little mention of direct connectors, types of aspirating catheters, or endobronchial intubation. Why controlled and assisted respiration should be included in the section on equipment is a mystery because it could well have been discussed in an earlier chapter. There is much evidence that controlled respiration has a definite place in anesthesia and for this reason should have been discussed more thoroughly. A discussion of the method of controlled respiration, rhythm, and correlation to blood circulation would have added much to a monograph of this nature.

Preanesthetic medication is considered here and the importance of atropine is emphasized. There are few who will support the author's routine use of quinidine preoperatively. The section on the choice of an anesthetic agent and technic ascribes little virtue to any agent but ether. That this view is fallacious is evident in the fact that a large percent of anesthesiologists use other agents quite satisfactorily.

In the section on the operative and postoperative care of the patient the author manifests a real concern for the patient and many of his points are well taken. There is some controversy as to the use of 100 percent oxygen as a "flushing" agent as this may cause postoperative atelectasis. Bronchoscopy when indicated and performed by a competent bronchoscopist is certainly invaluable. The section on the care of infants and children offers little that is new and is far too large a subject to be considered so briefly. The heading "Other Transthoracic Operations" contains many helpful suggestions.

This monograph is a handbook of anesthesia as practiced and taught by the author. His technics are apparently successful but his condemnation of other technics may lead to disagreement by other anesthesiologists.—*Lt. F. M. Thornburg, MC, U. S. N.*

*Progress in Ophthalmology and Otolaryngology, A Quadrennial Review, Volume 1, Part One, Ophthalmology, edited by Meyer Wiener, M. D., and A. Edward Maunenee, M. D. Part Two, Otolaryngology, edited by Percy E. Ireland, M. D., and Joseph A. Sullivan, M. B. 666 pages; illustrated. Grune & Stratton, Inc., New York, N. Y., publishers, 1952. Price \$15.*

This book is a continuation of the idea which was conceived during World War II of reviewing "Ophthalmology in the War Years." It is divided into 2 parts; part 1 dealing with progress in ophthalmology between 1946 and 1950 and part 2 with the field of otolaryngology. All the phases of each field are covered in a concise but adequate manner by recognized authorities. A ready source of the current concepts of these fields is presented with an extensive bibliography.—*Capt. R. R. Powell, MC, U. S. N.*

*Diseases of the Heart and Circulation*, by Albert A. Fitzgerald Peel, M. A., D. M. (Oxon.), F. R. F. P. S. (G), Physician for Diseases of the Heart, Victoria Infirmary, Glasgow; Medical Consultant, Department of Health for Scotland and Ministry of Labour and National Service Recruiting Boards; Formerly Professor of Medicine, Anderson College of Medicine, Glasgow; Formerly Visiting Physician, E. M. S., Scotland. 2d edition. 472 pages, illustrated. Oxford Medical Publications. Geoffrey Cumberlege, Oxford University Press, New York, N. Y., publisher, 1952. Price \$7.50.

This introduction to the study of cardiovascular disease is the outgrowth of a series of lectures to medical students given by the author. The new edition incorporates recent advances in the knowledge of cardiovascular physiology which has resulted from phonocardiography, angiography, and cardiac catheterization, without becoming involved with the details of these technics. The incorporation of new material has necessarily lengthened the book. Clinical methods available to the general practitioner are stressed. The first 94 pages are devoted to a detailed discussion of history taking, physical examination, and roentgenographic studies of patients with cardiovascular diseases. The discussion of cardiac findings in roentgenographic and fluoroscopic studies is particularly good, and the text is illustrated by excellent roentgenographic plates. Traumatic cardiovascular lesions are well covered. Discussion of the common types of heart disease is thorough.

Certain viewpoints expressed in this work will meet with some opposition in this country. The author believes that quinidine has an undeserved reputation for conversion of paroxysmal tachycardias, making no distinction between supraventricular and ventricular tachycardias in this regard. Atrial fibrillation and flutter are explained on the classic "circus movement" theory. The author finds few indications for conversion of atrial fibrillation to normal rhythm, and believes that for this reason the use of quinidine is contraindicated in long standing fibrillation, and absolutely so in patients with a history of former embolism. He recommends fluid restriction as well as sodium restriction in the treatment of cardiac failure. Although anticoagulant therapy is introduced in this edition, only one paragraph is allotted to the technic of its use, and the author does not mention the need for a prothrombin determination prior to the administration of the initial doses of dicumarol or bromhexane.

As a whole, this book achieves the author's objective. It will continue to be of value to medical students and practitioners as an introduction to cardiology, and will serve well those who desire a brief review of the subject.

—Col. B. E. Pollock, MC, U. S. A.

*The opinions expressed in this publication are not necessarily those of the Department of the Army, Department of the Navy, Department of the Air Force, or Department of Defense. References to regulations, orders, circular letters, or directives are for information only and do not, by publication herein, constitute authority for action. Any reference to a proprietary drug or its chemical formula shall not constitute an endorsement of its efficacy or use in the treatment of any disease.*

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# UNITED STATES ARMED FORCES MEDICAL JOURNAL

*Published Monthly by the Armed Forces Medical Publication Agency, Department of Defense*



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ROBERT J. BENFORD, Colonel, U. S. A. F. (MC), Associate Editor  
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THE PRINTING OF THIS PUBLICATION HAS BEEN APPROVED BY  
THE DIRECTOR OF THE BUREAU OF THE BUDGET, OCT. 19, 1949

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UNITED STATES  
GOVERNMENT PRINTING OFFICE  
WASHINGTON : 1952

For sale by the Superintendent of Documents, U. S. Government Printing Office  
Washington 25, D. C. Price 45 cents (single copy) Subscription price  
\$3.25 a year; \$1.25 additional for foreign mailing.

## FOREWORD

The *United States Armed Forces Medical Journal* is the medium for disseminating information of administrative and professional interest to all medical personnel of the Department of Defense. The Chairman of the Armed Forces Medical Policy Council and the Surgeons General of the several services invite all medical officers, dental officers, Medical Service Corps officers, Nurse Corps officers, and officers of the Veterinary Corps of the Armed Forces, and the medical consultants of the Army, Navy, and Air Force to submit manuscripts for publication in this *Journal*.

MELVIN A. CASBERG, M. D.,

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*United States Army.*

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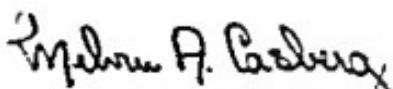
## Monthly Message

"The past years of combat experience have taught me the absolute necessity of competent and adequate medical support for the success of a military mission." These were the words of General Ridgway as he addressed a special session of the top medical military leaders of the NATO countries recently gathered at SHAPE, and continuing in his role as Supreme Allied Commander Europe, the General pledged his support to any realistic program developed to strengthen the medical organizations under his command.

Not only was the immediate beneficial psychologic impact of such a supportive statement quite evident, but equally obvious was the fact that the effects of such an assurance would be observed for some time to come as measured by unified efforts to resolve our common problems. Though the three short days of the session barely permitted an appreciation of the numerous tasks awaiting solution, this realization in itself afforded a definite stimulus for future progress. The necessity for coordination and a certain degree of uniformity in basic field medical activities was evident as exemplified by requirements for uniform field emergency medical tags, narcotic dosages, stretchers, immunizations, and other related items.

The United States was represented by the Chairman and members of the Armed Forces Medical Policy Council. Besides the orientation briefings and technical discussions, papers covering such subjects as the correct use of blood derivatives, forward combat medical care, and methods of evacuation of the wounded were presented by delegates from the United Kingdom, France, and the United States.

The personnel of the medical division of SHAPE under the direction of Brig. Gen. William Kennard are to be complimented for accomplishing a difficult organizational task in a most efficient manner.



Melvin A. Casberg, M.D., Chairman  
Armed Forces Medical Policy Council  
Office of the Secretary of Defense

# ACUTE RENAL INSUFFICIENCY

PAUL D. DOOLAN, *Lieutenant, MC, U. S. N. (1)*

**A**CUTE renal insufficiency is variously known as lower nephron nephrosis, crush syndrome, acute urinary suppression, hemoglobinuric nephrosis, traumatic anuria, and necrotizing nephrosis. All of these descriptive titles have reference to a temporary inadequacy of the excretory and metabolic functions of the kidney which follows a variety of causes. Inadequacy of excretory function is the problem of immediate concern and may be defined as the inability of the body to produce a urine of sufficient volume and/or concentration to prevent the retention of metabolites. For the average adult a minimum of from 300 to 400 cc. of maximally concentrated urine will preserve homeostasis, but this value will vary depending on the energy metabolism of the body and the ability of the renal tubules to do osmotic work.

## ETIOLOGY

The causative agents are so numerous that the clinician may find it helpful to think in terms of etiologic groups even though this leads to some oversimplification. They cannot be rigidly differentiated and in many patients several causes are demonstrable. The groups are: (1) shock resulting from hemorrhage, trauma, severe dehydration, or any other cause; (2) tissue destruction resulting from crushing injuries, burns, hemolytic reactions, premature separation of the placenta, et cetera; (3) cytologic poisons such as bichloride of mercury, carbon tetrachloride, uranium, oxalates, sulfonamides, et cetera; and (4) bilateral cortical necrosis of the kidney caused by a variety of agents and perhaps of a separate and distinct pathogenesis. (Metabolic alkalosis may seriously impair renal function but whether it should be added as a fifth group is debatable.)

A thorough knowledge of the underlying pathologic physiology is vitally necessary in the management of patients with acute renal insufficiency. Accordingly the salient concepts relative to the etiologic agents, the kidney, cellular metabolism, and the insensible water loss will be presented in some detail.

## PATHOLOGIC PHYSIOLOGY: THE ETIOLOGIC AGENTS

*Group 1.* The kidney reacts poorly to blood and oxygen deprivation: (1) because glomerular filtration requires an arterial pressure

(1) Formerly Senior Assistant Resident in Medicine and Fellow in the Department of Metabolism and Endocrinology, Georgetown University Hospital, Washington, D. C.

of from 60 to 70 mm. of mercury and may fall to levels less than those causes a cessation of filtrate formation; (2) more important, whenever systemic hypotension occurs a vasoconstriction of the renal vessels takes place and blood is shunted away from the kidneys to more vital organs such as the brain and heart (2-3) (whether humoral or aural stimuli are responsible for this reaction is not known but the result is the same in that a marked decrease in renal blood flow occurs); and (3) coincidentally with this ischemia, hypoxia of the kidney tissue develops. Normally, about 1,500 cc. of blood flows through the kidneys each minute, from each 100 cc. of which the parenchyma extracts from 0.5 to 2 volumes of oxygen. Despite this low extraction ratio the total oxygen consumption lies in the neighborhood of from 10 to 20 cc. per minute because of the large total volume of blood traversing the kidney each minute (5). Therefore any substantial reduction in the renal blood flow ordinarily results in hypoxia. An additional encumbrance in renal defense has been demonstrated (2-3). When hypotensive patients are transfused sufficiently to restore the systemic blood pressure and cardiac output to within normal limits, the renal blood flow remains subnormal and a lag period ensues before normal values are achieved. Thus hypotension is responsible for kidney damage because of cessation of glomerular filtration, vasoconstriction, and hypoxia.

Group 2. Whenever tissue is destroyed or rendered ischemic a variety of toxins and pigmented compounds are liberated into the circulation (4, 6, 7). The substances of chief importance appear to be hemoglobin, the oxygen carrier of the blood, and myoglobin, the oxygen carrier of muscle. The myoglobin molecule is only  $\frac{1}{4}$  as large as that of hemoglobin and has been found to filter 25 times as rapidly (8). Because its structure closely resembles that of hemoglobin it is capable of giving a positive test for blood when excreted in the urine, and in such cases identification must be made by spectrographic analysis. These compounds will not cause kidney damage unless they are precipitated within the tubule and this requires an acidic end con-

(2) Lawson, H. O., Bradley, S. E., and Coward, A.: Renal circulation in shock. *J. Clin. Investigation* 13: 381-402, May 1944.

(3) Selkurt, E. E.: Renal blood flow and renal clearance during hemorrhage shock. *Am. J. Physiol.* 145: 699-709, Mar. 1946.

(4) Corcoran, A. C., and Page, L. H.: Crush syndrome; post-traumatic anuria; observations on genesis and treatment. *J. A. M. A.* 134: 436-441, May 31, 1947.

(5) Cargill, W. H., and Hickam, J. B.: Oxygen consumption of normal and diseased human kidney. *J. Clin. Investigation* 28: 526-532, May 1949.

(6) Bywaters, E. G. L.: Ischemic muscle necrosis, crushing injury, traumatic edema, crush syndrome, traumatic anuria, compression syndrome, type of injury seen in air raid casualties following burial beneath debris. *J. A. M. A.* 124: 1103-1109, Apr. 15, 1944.

(7) Bywaters, E. G. L., and Beall, D.: Crush injuries with impairment of renal function. *Brit. M. J.* 1: 427-432, Mar. 22, 1941.

(8) Yule, C. L., and Clark, W. F.: Myohemoglobinuria, study of renal clearance of myohemoglobin in dogs. *J. Exper. Med.* 74: 187-196, Sept. 1941.

centrated tubular fluid. (The patient's state of hydration is also important. Dehydration favors precipitation.) The mechanical blockage that results impairs the function of the involved and adjacent nephrons. Hemoglobin and myoglobin are not directly injurious to renal tissue but their degradation products which arise after precipitation in the tubules can give rise to acid hematin which is a definite cytotoxic poison. It is a debated point as to whether these substances, *per se*, are capable of causing acute renal failure and most patients encountered bear evidence of an additional factor such as a period of shock. Their presence, in addition, undoubtedly results in more severe damage than that accompanying shock alone. Thus tissue destruction is responsible for some degree of kidney damage because of liberation of pigmented compounds capable of mechanically blocking and chemically injuring the renal tubules.

*Group 3.* The cytologic poisons cause renal failure by a direct action on the kidney parenchyma. The inflammatory response elicited potentiates the damage and prolongs recovery by interfering with the circulation and oxygenation of the involved and adjacent tissue.

*Group 4.* Bilateral cortical necrosis of the kidneys is an unusual cause of acute renal insufficiency most often encountered in pregnancy but also in men and children (9-11). Although most patients with this condition have died, with the use of newer methods of treatment, some such patients have survived. This condition can be produced experimentally by the injection of certain toxins which cause vasoconstriction and thrombus formation in the smaller arteries and arterioles of the renal cortex. This intense vasoconstriction may be due to a mechanism similar to that described by Trueta et al. (12).

The English investigators described a mechanism whereby, after application of a tourniquet to the hind leg of a rabbit, the renal flow would remain normal in amount but would traverse a completely different course. The basis of this rerouting devolves on the juxtamedullary glomeruli whose efferent branches drain directly into larger venous channels without the intermediation of a capillary bed such as occurs in all other cortical circuits. Under the above experimental circumstances cortical vasoconstrictions shunts all of the blood into the veins via the patent juxta-

(9) Duff, G. L., and More, R. H.: Bilateral cortical necrosis of kidneys. Am. J. M. Sc. 201: 428-450, Mar. 1941.

(10) Haft, D. E., and Prior, J. T.: Bilateral cortical necrosis of kidneys following treatment of an unusual case of heart block. Ann. Int. Med. 34: 1483-1491, June 1951.

(11) Kimmelstiel, P.: Vascular occlusion and ischemic infarction in sickle cell disease. Am. J. M. Sc. 216: 11-19, July 1948.

(12) Trueta, J.; Barclay, A. E.; Daniel, P. M.; Franklin, K. J.; and Pritchard, M. M. L.: Studies of the Renal Circulation. Charles C Thomas, Publisher, Springfield, Ill., 1947.

medullary glomeruli and the resulting cortical ischemia is the cause for the subsequent renal failure. Other investigators have acknowledged the importance of vasoconstriction in the genesis of acute kidney failure but do not believe it occurs in such a manner. Direct and indirect measures of the renal blood flow have shown it to be markedly reduced rather than normal in amount as Trueta found (2-3, 13, 14).

Studies on the oxygen extraction ratio have yielded normal values, but if shunting were operative the blood should perfuse only the metabolically inactive medulla and should not be using a normal percent of oxygen. These studies have been unable to reproduce the experimental animals other than the ..... ..... as the preponderance of evidence is against the importance of bypasses in the pathogenesis of acute renal insufficiency. Whether bilateral cortical necrosis of the kidney is an exception to this remains to be proved.

### PATHOLOGIC PHYSIOLOGY: THE KIDNEY

Once the damage has been sustained by the renal parenchyma the urine volume abruptly declines. The exact cause of the oliguria is unknown but at least 3 factors are operative: (1) back diffusion of the filtrate across the tubular epithelium; (2) functional ischemia of the cells; and (3) mechanical blockage of the tubules by casts. The role played by each of these factors, singly or in combination, varies with the agent responsible for the renal failure. A comprehensive review of this subject has been made by Smith (18).

Regeneration of the tubular epithelium begins soon after the injury and continues in such a fashion that back diffusion of the filtrate is progressively curtailed. Concomitantly, the renal blood flow and glomerular filtration rate improve and these changes are witnessed by the passage of increasingly larger volumes of urine. This should be viewed only as an encouraging sign for the tubular epithelium has by no means regained its normal

(13) Sirola, J. H.: Carbon tetrachloride poisoning in man; mechanisms of renal failure and recovery. *J. Clin. Investigation* 28: 1412-1422, Nov. (pt. 2) 1949.

(14) Moyer, J. H., and Greene, J. A.: Further studies on existence of renal bypasses. *Am. J. Med.* 9: 280, 1950.

(15) Clark, J. K.; Barker, H. G.; and Crosley, A. P., Jr.: Evidence against renal vascular shunts in case of lower nephro nephrosis. *Am. J. Med.* 9: 268-271, Aug. 1950.

(16) Moyer, J. H.; Conn, H. L., Jr.; Mathley, K.; and Schmidt, C. F.: Hemodynamics of renal circulation. *Am. J. Physiol.* 159: 587, 1949.

(17) Study, R. S., and Shupley, R. E.: Effects of renal artery-serve stimulation on renal blood flow measured directly and by clearance and extraction of diodrast. *Am. J. Physiol.* 159: 392, 1949.

(18) Smith, H. T.: *Kidney. Structure and Function in Health and Disease*. Oxford University Press, New York, N. Y., 1951.

faculties of selective reabsorption and the renal hemodynamics are still far from normal. For instance, if tubular reabsorption is poor, as much as 5,000 cc. of urine may be excreted in 24 hours when the glomerular filtration rate is less than 5 percent of normal. Although clearance measurements during the early phases of diuresis have been found to be extremely low, it should be remembered that their absolute values bear no correlation with the ultimate outcome of the disease (13). In addition, during this same period, the tubules apparently deal normally with the chloride ion even though other transport mechanisms remain severely impaired.

From 7 to 9 days after diuresis begins the clearance values rapidly improve and continue to do so during the next 5 to 7 weeks but thereafter improvement takes place more moderately and normal values are arrived at by the sixth or seventh month. Studies to date have failed to show any consistent pattern in the time that all renal function tests will have reverted to normal but the ability to form a concentrated and strongly acidic urine are usually among the last to recover.

#### PATHOLOGIC PHYSIOLOGY: CELLULAR METABOLISM AND THE INSENSIBLE WATER LOSS

Coincidentally with the changes which take place within the kidney, normal cellular catabolism liberates 3 important groups of substances into the extracellular fluid: (1) the end products of metabolism including organic acids, (2) osmotically potent electrolytes, and (3) the molecularly contained water. The end products of protein metabolism are of major consequence to the oliguric patient because they demand renal excretion while the carbon dioxide produced by the oxidation of carbohydrate and fat is readily expired. Although ketosis can be prevented by supplying sufficient carbohydrate the accumulation of other organic acids cannot be so easily controlled.

Osmotically potent electrolytes also gain egress from the cells as a result of catabolic processes. The ion of gravest interest being potassium whose chief route of elimination from the body is via the kidney. The intracellular concentration of potassium is about 30 times as great as that found in the extracellular fluid and this gradient differential in the presence of ablated renal function facilitates its accumulation in the extracellular fluid where excessive concentrations of potassium are fatal. Cellular catabolism also affects the body fluids directly. The oxidation of carbohydrates, protein, and fat yields water, the so-called water of oxidation, and the average adult requires about 250 cc. (3.1 cc. per kg. of body weight) in this way each day.

This chain of events is responsible for the azotemia and metabolic acidosis which develops in the oliguric patient and in addition sets the stage for the poorly understood electrolyte shifts and distortions which take place in the various body fluid compartments. The severity of many features which the patient presents are the direct result of the rapidity with which cellular destruction has occurred and rational management is, therefore, aimed at reducing endogenous catabolism to a minimum.

In addition to the changes which take place within the kidney and the cells and fluids of the body, the concomitant insensible water loss is important, because it becomes of critical significance in the oliguric patient and in the absence of diarrhea, vomiting, and visible perspiration is the only path by which fluid leaves the body. Because the evaporation of 1 gram of water requires 0.58 calories, the vaporization of water from the skin and lung surfaces is a means for the disposal of heat, and the total amount lost in this manner per day is an independent function of the energy metabolism of the body. The fluid lost is devoid of electrolytes. The precise amount expended by a normal man weighing 70 kg. varies between 840 and 1,000 cc. per day depending on the respiratory quotient, the environmental temperature, humidity, and air currents as well as the type and amount of clothing worn (19-21).

Strauss (22) called attention to the fact that liver damage also occurs in patients with acute renal insufficiency. Other than in carbon tetrachloride poisonings and in one patient with bichloride of mercury intoxication we have made no special studies of this problem.

### PATHOLOGY

The pathologic changes which take place in the kidney have been well described (7, 23, 24). Certain features vary depending on the etiologic agent but salient characteristics are common to all types of acute renal insufficiency. Grossly, the kidneys are swollen, tense, and weigh more than the normal 300 grams. The pale cortex and dusty-looking medulla produces an appearance

(19) Newburgh, L. H., and Johnston, M. T.: Insensible loss of water. *Physiol. Rev.* 22: 7-18, Jan. 1942.

(20) Gamble, J. L.: Physiological information gained from studies on life salt ratios. *Harvey Lect.* (1946-1947) 42: 247-273, 1947.

(21) Gamble, J. L.: *Chemical Anatomy, Physiology and Pathology of Extracellular Fluid*. 5th edition. Harvard University Press, Cambridge, Mass., 1947.

(22) Strauss, M. B.: Acute renal insufficiency due to lower-nephros nephrosis. *New England J. Med.* 239: 693-700, Nov. 4, 1948.

(23) Lucke, B.: Lower nephros nephrosis (renal lesions of crash syndrome, of burns, transfusions, and other conditions affecting lower segments of nephros). *Mil. Surgeon* 99: 372-396, Nov. 1946.

(24) Marbsdorff, E. E.: *Acute renal insufficiency*. Medical Basic Sciences Course, Army Medical Center Graduate School, Washington, D. C., 1949.

of increased corticomedullary demarcation. Microscopically, changes are seen in the epithelium within from 18 to 24 hours after trauma. These may progress so that eventually all gradations of injury, including necrosis of some cells, are visible. Usually the involvement is patchy in distribution. Sometimes the changes are more severe in the proximal convoluted tubule but usually the distal tubule bears the brunt of the injury. Pigmented casts appear within from 36 to 72 hours. Inflammatory reaction and edema are visible in the interstitial tissue and at times numerous tubulovascular anastomoses may be present. Occasionally, glomerular changes and hypertrophy of the juxtaglomerular apparatus are demonstrable. The tubular epithelium begins to regenerate by about the fourth day and is fairly complete within from 2 to 4 weeks. Rarely, flat films of the abdomen reveal necrotic epithelium which has undergone calcification lying in the lumen of the tubules.

The specific lesions seen in bilateral cortical necrosis include widespread ischemic necrosis of the cortex which may be patchy in distribution or include the entire cortex as well as the columns of Bertin. In the areas of necrosis there is extensive thrombosis of the smaller arteries.

### CLINICAL FEATURES

The clinical course of this syndrome varies with the precipitating cause and basic illness. Most patients who succumb do so as a direct result of the basic illness, and before uremia becomes a problem. Ordinarily, anuria or oliguria results within 24 hours after the damage has been sustained. The anuria is transient, being measured in hours and virtually all patients have an oliguria. Early in the course the urine is usually acid, has a specific gravity of from 1.009 to 1.014 (occasionally higher), and is smoky or cloudy in appearance. Sometimes it gives a positive test for occult blood, and pigment may continue to be passed for 3 or 4 days but then this clears completely. This early urine contains a great deal of albumin; granular, cellular, and broad renal-failure casts; numerous cells; and amorphous minerals. As more urine is passed, the amount of sediment progressively decreases and the specific gravity remains fixed at about 1.010.

In the first 5 or 6 days there is a gradually progressive elevation of the serum urea nitrogen, nonprotein nitrogen, phosphates, and sulfates. The serum creatinine rises rapidly at first and it is not until the second week that smaller increments of ascent are noted. The serum sodium and chloride usually fall in a parallel manner, at first gradually, but then more rapidly with the fall in chloride being proportionally greater. Concomitantly the carbon dioxide content falls and acidosis increases in

severity. During this first period the patient may continue to feel well but as the second week begins a progressive apathy usually attended by nausea and vomiting develops. This may continue until there is almost continual somnolence and finally severe uremia with coma. There is no correlation between the severity of uremia and the eventual outcome.

All patients who do not have diarrhea and who remain oliguric long enough, develop potassium intoxication. This may be rapidly lethal and because effective means of treatment are available, early detection is important. The electrocardiographic changes which appear earliest in intoxication include: (1) an increase of height and pointing of the T waves, then slanting of the S-T segment followed by prolongation of the P-R interval, and later disappearance of the P waves; (2) as the poisoning continues the QRS complexes become prolonged, the R wave is lowered, and eventually the QT interval is markedly prolonged; and (3) terminally, arrhythmias develop and finally asystole. There is no correlation between the electrocardiographic changes and the height of the serum potassium so that both determinations should be performed. The neurologic changes occur later and are the same for both hyperkalemia and hypokalemia. There is areflexia and flaccid paralysis which may be of an ascending type. Aphonia and respiratory distress occur late. Paresthesias occur in patients with hypokalemia more frequently than in those with hyperkalemia. Intoxication can occur before uremia becomes well marked and a low serum sodium level facilitates the development of potassium intoxication.

There is no uniformity to the precise acid-base and fluid-balance derangements that develop in different patients. This is due, in large measure, to iatrogenic causes. Despite repeated warnings excess fluid and base continue to be given to a large number of these patients. Because pulmonary edema is still one of the most frequent causes of death, this procedure cannot be condemned too harshly. In other patients base has been omitted but water administered in excess. These patients, especially if the serum sodium was low initially, may develop water intoxication. If this condition progresses, the serum osmolarity falls, the spinal fluid pressure rises, and convulsions occur. This demands immediate treatment with hypertonic saline and carries with it the risk of precipitating acute pulmonary edema.

Periorbital edema is sometimes seen in oliguric patients in the absence of peripheral edema. Some elevation of blood pressure occurs in almost all patients and usually is of a mild form. The hypertension may appear as early as the third day of oliguria or not until diuresis has become well established. Convulsions may occur in the absence of hypertension.

Diuresis ordinarily begins between the seventh and fourteenth days but may not appear until later. Diuresis may appear late in patients with chronic renal disease in whom acute renal insufficiency is superimposed. Usually the uremia does not attain its meridian until from 4 to 9 days after diuresis has commenced. Once large urine volumes are achieved the danger is by no means over. Pulmonary edema may still result from overzealous administration of fluids. Water intoxication or salt depletion states develop because of failure to replace the electrolytes lost in the copious urine. Dehydration may result from inadequate fluid replacement because of failure to appreciate that the insensible water loss continues and that the kidneys do not regain their capacity to concentrate until later. Potassium deficiency is frequently encountered.

In addition to these, another distressing complication may occur. Luetscher and Blackman (25) noted a marked elevation of serum sodium and chloride associated with severe brain damage during the diuretic phase in patients with acute renal insufficiency resulting from sulfathiazole. Borst (26) also observed marked elevation of the serum chloride and hyperazotemia associated with low to absent urinary sodium chloride reabsorption of sodium and chloride during this phase may occur in patients with gastrointestinal hemorrhages. Excessive tubular reabsorption of sodium and chloride during this phase may occur in acute renal insufficiency from other causes. Little can be done in the way of treatment other than restriction of salt intake although Merrill (27) has successfully treated such patients with an artificial kidney.

### THERAPY

Because acute renal insufficiency presents a succession of developments and problems, therapy must be adaptable in character and well founded in principle. Some simple prophylactic measures may prevent the development of this condition. Dehydrated and anemic patients should be thoroughly prepared to withstand any stress. Shock must be detected early and treated vigorously. Specific antidotes such as BAL should be administered as soon as possible after poisoning. Precautionary measures must be enforced with all intravenous infusions, and in transurethral prostatic resections the wound should not be irrigated with distilled water. In hemolytic reactions, mercury intoxication, and other causes of oliguria, it is wise to insert a bladder

(25) Luetscher, J. A., Jr., and Blackman, S. S., Jr.: Severe injury to kidneys and brain following sulfathiazole administration; high serum sodium and chloride levels and persistent cerebral damage. Ann. Int. Med. 18: 741-756, May 1943.

(26) Borst, J. G. G.: Cause of hyperchlorolemia and hyperazotemia in patients with recurrent massive hemorrhage from peptic ulcer. Acta med. Scandinav. 97: 68-88, 1938.

(27) Merrill, J. P.: Artificial kidney. New England J. Med. 246: 17-27, Jan. 3, 1952.

catheter and measure the urine collections hourly. In this manner the fear of anuria will not prevent proper hydration therapy; acute renal insufficiency may be prevented, and if not, its presence will be detected early.

The following outline and generalizations describe the conservative management of the oliguric phase.

1. Intake and output records should be accurate to the cubic centimeter.

2. Body weight measurements should be made using the same scale at the same time each day.

3. The daily fluid intake should be limited to the replacement of the insensible water loss in addition to the total amount of urine, stool, and vomitus collected.

4. At least 100 grams of carbohydrate should be provided daily.

5. Daily or every other day, the following laboratory determinations should be performed: hematocrit, serum urea nitrogen, carbon dioxide combining power, chloride, sodium, and potassium. Less frequently needed are: total serum proteins, calcium, phosphorous, and creatinine. Serial determinations of the serum osmolarity, if available, are of distinct value.

6. An ECG should be taken every other day.

7. Prophylactic penicillin or proper antibiotic therapy should be instituted.

8. Vitamins (including fat soluble) are routinely prescribed.

The necessity of keeping precise intake and output records cannot be overemphasized. Errors are simple to make even under optimal clinical conditions and in an insidious manner produce serious complications. For instance, infusions do not contain exactly 1,000 cc. as many physicians assume, but usually about 115 cc. in excess of this. Over a period of several days the accumulated excess may cause congestive heart failure.

As a valuable adjunct to fluid balance records in guiding therapy and because it frequently is impossible to estimate the amount of vomitus or liquid stools passed, all patients should be weighed daily on scales accurate to at least 250 grams. Stretchers and special scales are available for weighing bedridden patients.

The insensible water loss is adequately replaced, in the clinical sense, by giving 0.5 cc. per kg. of body weight per hour (20, 21). Electrolyte determinations performed on aliquots of the urine, vomitus, and fecal material aid in replacing those lost. Equivalent volumes of fluid are used to replace those

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passed. If facilities are not available for daily electrolyte determinations, pH values by means of nitrazine paper should be made on all fluids eliminated.

Acidosis invariably develops and it is difficult to treat because of ionic shifts occurring between the extr- and intracellular compartments in addition to other poorly understood phenomena. Because treatment is fraught with the hazard of producing congestive heart failure the clinician should proceed cautiously. At times, hypertonic solutions of base in small volumes given slowly are of distinct value.

Minimizing cellular catabolism inhibits endogenous protein breakdown, the progression of azotemia, acidosis, and potassium intoxication, as well as distributional changes in the body fluids. Such a minimizing of cellular breakdown can be effectively accomplished in the normal human subject by the daily provision of 100 grams (400 calories) of glucose (20, 21). This quantity has been accepted by many as the optimal amount to be given to the oliguric patient. Others have stated that more salutary results are accomplished by providing from 1,700 to 2,500 calories in the form of carbohydrate and fat (18, 28-30). Analysis of Butler's (31) own data would seem to corroborate this.

I have used mixtures containing from 800 to 1,800 calories in the form of glucose and oral fat emulsion, given slowly by intragastric drip. Testosterone and lipotropic agents were administered concomitantly. These substances were originally recommended to me by Merrill. Infrequently, this method of administration was not tolerated or was contraindicated and in such instances, at least 400 calories were provided by vein. In such patients the use of plastic venous catheters has proved to be of material help.

The treatment of potassium intoxication has been admirably studied by Merrill et al. (32). Experience with the modified Kolff artificial kidney has led me to believe that it is the most rapid and effective means of treatment. Hemodialysis has consistently produced satisfactory results of a more permanent nature than have been obtained by any other means. Treatment

(28) Borst, J. G. G.: Protein catabolism in uremia; effects of protein-free diet, infusions, and blood-transfusions. *Lancet* 1: 824-828, May 29, 1948.

(29) Bull, G. M.; Jockes, A. M.; and Lowe, K. G.: Conservative treatment of anuric uremia. *Lancet* 2: 229-234, Aug. 6, 1949.

(30) Saarper, L.: Management of acute renal failure. *Bull. New York Acad. Med.* 25: 199, 1949.

(31) Butler, A. M.: Minutes of the Conference on Metabolic Aspects of Convalescence including Bone and Wound Healing. 8th meeting, Josiah Macy, Jr. Foundation, New York, N. Y., Oct. 13-14, 1944, p. 177.

(32) Merrill, J. P.; Levine, H. D.; Somerville, W.; and Smith, S., III: Clinical recognition and treatment of acute potassium intoxication. *Ann. Int. Med.* 33: 797-830, Oct. 1950.

by means of resins and intermittent peritoneal lavage hold some promise but require further study. Calcium, hypertonic saline solution, glucose and insulin, DUCAT, and gastrointestinal lavage have not proved to be satisfactory methods of treatment.

One should not be led to believe that acute renal insufficiency will run a self limited course and that all that is needed is the above schema of conservative management. The general features presented by a healthy young man who accidentally inhaled carbon tetrachloride and the elderly postoperative patient are entirely different even though both have acute renal insufficiency. Major problems of interplay between the basic illness, the complicating conditions, and the oliguria are ever present. Some such problems in the oliguric patient are congestive heart failure, reoccurrence of shock, severe diarrhea or gastrointestinal hemorrhage, infection, high fever, and the problems of drug dosages and reactions which may arise with digitalis, antibiotics, BAL, et cetera. In patients particularly difficult to treat and those with potassium intoxication, other modalities in addition to conservative therapy have proved to be lifesaving. Of these other therapeutic modalities the following are the most important (27).

**Artificial kidney.** Many types have been developed (33-37). The modified Kolff model described by Merrill et al. (38, 39) has been used extensively with excellent results. It rapidly and effectively removes metabolites and corrects acidosis in addition to being the treatment par excellence for potassium intoxication. It removes or greatly improves the signs and symptoms of uremia thereby facilitating clinical management. In some instances pulmonary edema may be cleared and the blood pressure beneficially raised by dialysis. Its disadvantages are that a specially trained physician or team as well as rather elaborate hospital and laboratory facilities must be available in order to operate it safely and effectively. Its use is therefore limited to the larger medical institutions.

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- (33) Kolff, W. J.: *New Ways of Treating Disease*. J. & A. Churchill, Ltd., London, 1947.  
(34) Murray, G.: Development of artificial kidney; experimental and clinical experiences. *Arch. Surg.* 55: 505-522, Nov. 1947.  
(35) Alwall, N.: On artificial kidney: apparatus for dialysis of blood *in vivo*. *Acta med. Scandinav.* 128: 317-325, 1947.  
(36) Gregg, L. T., Jr., and Leonard, J. R.: Studies on artificial kidney; preliminary results with new type of continuous dialyzer. *Science* 108: 212-213, Aug. 27, 1948.  
(37) Kolff, W. J.: Artificial kidney; treatment of acute and chronic uremia. *Cleveland Clin. Quart.* 17: 216-228, Oct. 1950.  
(38) Merrill, J. P.; Thor, G. W.; Walker, C. W.; Callahan, E. J., III; and Smith, L. H., Jr.: Use of artificial kidney; technique. *J. Clin. Investigation* 30: 412-424, Apr. 1951.  
(39) Merrill, J. P.; Smith, S., III; Callahan, E. J., III, and Thor, G. W.: Use of artificial kidney; clinical experience. *J. Clin. Investigation* 30: 425-435, Apr. 1951.

The conventional form of *peritoneal dialysis* has usually proved to be a slow, prolonged, and cumbersome method of treating uremia that carries with it the risk of infection and fluid retention (40). As a consequence its value is questionable. The modification of intermittent peritoneal irrigation described by Grollman et al. (41) may prove to be more effective and practical but requires further investigation.

*Replacement transfusion* is a method of removing metabolites that has been used by Dausset (42) and others and which is sometimes combined with peritoneal irrigation. The large volumes of fresh blood required and the dangers of homologous serum jaundice, hemolytic reactions, and congestive heart failure weighed against the moderate amounts of urea removed by repeated replacement transfusions fail to justify this method.

Because the mucosa of the gastrointestinal tract is not a simple dialyzing membrane *gastrointestinal irrigations* have not proved to be of any substantial aid in the management of the oliguric patient. The method is not a very effective means of clearing azotemia and it is particularly difficult to control the fluid and electrolyte balance of patients being treated with either intestinal or colonic irrigations. Perfusion of an isolated intestinal loop can be more accurately controlled and as many as 8.6 grams of urea have been removed by from 8 to 10 hours of this procedure (43). It is difficult to imagine the employment of such a procedure in acute renal insufficiency.

Hoffman and Marshall (44) have cautiously induced dependent edema as a means of diluting the products of retention, this overhydration being justified by the fact that edema is less injurious than uremia. This method is dangerous and should not be used in the oliguric patient for there is no certainty that pulmonary edema can be avoided. Perhaps in certain patients whose uremia is severe and continuing to progress even though diuresis has commenced, this method may be beneficially employed. Despite the fact that congestive heart failure may still occur, it can be more effectively treated once diuresis has begun

(40) Odel, H. M.; Ferris, O. O.; and Powers, M. H.: Peritoneal lavage as effective means of extrarenal excretion; clinical appraisal. Am. J. Med. 9: 63-77, July 1950.

(41) Grollman, A.; Turner, L. B.; and McLean, J. A.: Intermittent peritoneal lavage in nephrectomized dogs and its application to human beings. Arch. Int. Med. 87: 379-390, Mar. 1951.

(42) Dausset, J.: Lower nephron nephrosis: report of treatment of 44 patients by repeated replacement transfusions. Arch. Int. Med. 85: 416-431, Mar. 1950.

(43) Twiss, E. E., and Koff, W. J.: Treatment of uremia by perfusion of an isolated intestinal loop. J. A. M. A. 146: 1019-1022, July 14, 1951.

(44) Hoffman, W. S., and Marshall, D.: Management of lower nephron nephrosis. Arch. Int. Med. 83: 249, 1949.

and the danger of the procedure is thereby lessened. We (45) employed forced dilution to lower the serum nonprotein nitrogen in such a patient and obtained encouraging results.

### SUMMARY

Acute renal insufficiency may be caused by shock, tissue destruction, cytotoxic poisons, or bilateral cortical necrosis of the kidneys. The fundamental processes responsible for this condition are renal ischemia and hypoxia, tubular obstruction, and direct cytotoxic destruction of the tubular epithelium.

Oliguria is the result of the back diffusion of the filtrate, functional ischemia of the cells, and mechanical blockage of the tubules by casts. Diuresis serves only as an indication of incipient recovery because large volumes of urine may be passed even though the renal hemodynamics remain severely impaired. Full functional recovery requires about 6 months. Once oliguria supervenes the events taking place within the cells are important. As a direct result of these events, azotemia, acidosis, potassium intoxication, and distortions in the fluid compartments occur. The so-called insensible water loss is of critical significance in the oliguric patient. The amount of fluid lost in this manner is independent of the fluid balance of the body and the status of renal function. Fluid therapy should therefore always include adequate replacement of this expenditure.

There are no consistent pathologic findings, but the injury is usually patchy in distribution, generally maximal in the distal tubular segments, and inflammatory changes with edema are present in the interstitial tissues. Regeneration usually begins by about the fourth day and is fairly complete by the twenty eighth.

The clinical course varies with the precipitating cause and basic illness. Most fatalities are attributable to these factors and occur before uremia becomes a major problem. As oliguria persists, azotemia and metabolic acidosis become progressively more severe. As long as an inadequate volume of urine is passed, potassium intoxication remains a hazard. ECG's must be taken frequently. Distortions of the body fluids frequently occur in the form of peripheral and pulmonary edema and hypertension. After diuresis is established the development of salt and water depletion and hypokalemia should be prevented.

Therapy should be, first of all, prophylactic. During the oliguric phase the fluid balance and body weight records must be accurately kept. Fluid therapy should be limited to replacement

(45) Doolan, P. D., Kyle, L. H.; and Walsh, T. B.: Acute renal insufficiency due to bichloride of mercury, clinical observations and experimental studies. To be published.

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of the daily losses. Minimizing endogenous cellular catabolism by supplying an adequate caloric intake is important. Acidosis must be treated cautiously.

The artificial kidney is the most effective means available for treating potassium intoxication, clearing uremia, and correcting acidosis.

**ADDENDUM.** Since this manuscript was submitted, an article on the pathogenesis and pathology of acute renal failure has been published by Oliver, J.; MacDowell, M., and Tracy, A. *Pathogenesis of acute renal failure associated with traumatic and toxic injury; renal ischemia, nephrotoxic damage and ischemic episode*. *J. Clin. Investigation* 30: 1307-1439, Dec. 1951, in which they demonstrated the patchy distribution of "tubuloreticular" lesions throughout all parts of a scattered and variable number of nephrons resulting from renal ischemia. They also demonstrated that the lesions following ingestion of nephrotoxins was a necrosis without rhexis which equally involved the functionally concerned segment of all nephrons, and that casts, *per se*, were not directly injurious to the tubular epithelium.

## BOOKS RECEIVED

*Physiology of the Eye. Volume II. Vision*, by Arthur Linksz, M. D., F. A. C. S., Assistant Clinical Professor of Ophthalmology, New York University, Postgraduate School of Medicine; Associate Attending Surgeon, Manhattan Eye, Ear and Throat Hospital, New York, N. Y. 869 pages; illustrated. Grune & Stratton, Inc., New York, N. Y., publishers, 1952. Price \$19.

*Kitchen Strategy*, by Leona M. Bayer, M. D., Assistant Clinical Professor of Medicine, Stanford University School of Medicine, San Francisco, Calif., and Edith Green, Television Cooking Expert, San Francisco, Calif. 94 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1952. Price \$3.75.

*Connective Tissues, Transactions of the Third Conference*, February 14-15, 1952, New York, N. Y., edited by Charles Ragan, Department of Medicine, College of Physicians and Surgeons, Columbia University, New York, N. Y. Sponsored by the Josiah Macy, Jr. Foundation. 166 pages; illustrated. Printed by Progress Associates, Inc., Caldwell, N. J., 1952. Price \$3.50.

*Nerve Impulse, Transactions of the Third Conference*, March 3 and 4, 1952, New York, N. Y., edited by H. Houston Merritt, M. D., Professor of Neurology, College of Physicians and Surgeons, Columbia University, New York, N. Y. Sponsored by the Josiah Macy, Jr. Foundation. 176 pages; illustrated. Printed by Progress Associates, Inc., Caldwell, N. J., 1952. Price \$3.50.

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# EFFECT OF ANTIBIOTICS IN ABACTERIAL PNEUMONIA<sup>(1)</sup>

LeROY HOMER, First Lieutenant, MC, U. S. A.  
W. N. DONOVAN, Lieutenant Colonel, MC, U. S. A.  
RYLE A. RADKE, Colonel, MC, U. S. A.

MUCH of the pneumonia which is seen in young adults is abacterial in origin and, therefore, is of major concern to the Armed Forces. The experimental and clinical results reported on the efficacy of the various antibiotics in atypical pneumonia are conflicting. It is difficult to evaluate primary atypical pneumonia because the etiologic agent of primary atypical pneumonia has not been definitely isolated. Eaton<sup>(2)</sup> has demonstrated a definitely beneficial result from the use of aureomycin in the atypical pneumonia which he has transmitted to cotton rats. He was unable to demonstrate any beneficial effects from chloramphenicol.

The reports on the effectiveness of streptomycin<sup>(3)</sup> and aureomycin<sup>(4-15)</sup> are largely based on case reports or uncontrolled

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(2) Eaton, M. D.: Action of aureomycin and chloromycetin on virus of primary atypical pneumonia. Proc. Soc. Exper. Biol. & Med. 73: 24-29, Jan. 1950.  
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series. The series reported by Schoenbach et al. (14) is difficult to evaluate because it compared a group of patients treated with penicillin and sulfadiazine during the winter of 1946-1947 with another group treated with aureomycin during the winter of 1948-1949. Meiklejohn and Shragg (16) and Hilden and Nørgaard (17) presented well controlled series affirming the effectiveness of aureomycin. On the other hand, there are several case reports (7, 14, 18, 19) and a small controlled series (20) in which aureomycin was not found to be of value. Terramycin has been reported to be of the same order of effectiveness as aureomycin in primary atypical pneumonia based on small uncontrolled series (18, 21, 22). Chloramphenicol has also been reported to be of value in this disease (23, 24).

We have attempted to evaluate aureomycin and terramycin in abacterial pneumonia as it occurred at this hospital in the winter of 1951. Because of the overwhelming predominance of abacterial pneumonia at this hospital between January and June 1951, no attempt was made to select patients at the onset of therapy. After the laboratory studies were completed, patients that did not meet our criteria for the diagnosis of abacterial pneumonia were dropped from the series. Our criteria for inclusion in the study group were (1) compatible history and clinical course, (2) relatively normal total leukocyte and differential count, (3) pulmonary infiltrate on roentgenographic examination, (4) absence of pathogens in the sputum, and (5) negative serologic tests for other viral causes of pneumonia.

- (13) Collins, H. S.; Wells, E. B.; Gocke, T. M., and Finland, M.: Treatment of primary atypical pneumonia with aureomycin. *Am. J. Med.* 8: 4-20, Jan., 1950.  
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(23) Wood, E. J.: Atypical pneumonia treated with chloromycetin. *Lancet* 2: 55-56, July 9, 1949.  
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Leukocyte counts were obtained within the first 24 hours of admission and sputum was obtained for culture promptly on admission to the hospital prior to the institution of therapy. Roentgenograms of the chest were obtained at weekly intervals. Blood was drawn for serologic testing at the time of admission and at intervals of 10 days, 3 weeks, and 6 weeks after admission to the hospital. No positive results were obtained for *Q* fever or the psittacosis-lymphogranuloma venereum group of viruses. Two patients with elevated heterophil agglutination titers were dropped from the study. Many patients were tested for influenza agglutinins but because almost all the patients had been recently immunized with the standard influenza vaccine, those results could not be evaluated and were disregarded. Cold agglutinations and streptococcus MG agglutinations were performed on all patients. Ten significantly elevated titers were found; 5 patients had cold agglutinin titers of 1:32 or over; 3 had a 4-fold or greater increase in their streptococcus MG agglutinations; and 2 had increases in both streptococcus MG and cold agglutinin titers of this order.

The patients admitted in January, February, and March 1951 were designated as group 1. As they were admitted, the first patient was given 300,000 units of crystalline penicillin G intramuscularly every 6 hr. for 20 doses; the second was given 500 mg. of aureomycin by mouth every 4 hr. for 6 doses, then every 6 hr. for from 5 to 10 days; the third was given a placebo-filled capsule (identical in appearance with that of aureomycin) every 4 hr. for 6 doses, then every 6 hr. for about 1 wk.; and so on in rotation.

The patients in group 2 comprised those admitted in April, May, and June 1951. As they were admitted, the first patient was given penicillin as in group 1; the second was given 500 mg. of terramycin by mouth every 6 hr. for 20 doses; the third was given a placebo-filled capsule (identical in appearance with that of terramycin) every 6 hr. for 20 doses; and so on in rotation.

In each group, the patients were quite comparable as regards duration of illness prior to hospitalization, leukocyte counts, and temperature on admission.

## RESULTS

**Group 1.** Eighty-eight percent of those treated with penicillin, 91 percent of those treated with the placebo, and 83 percent of those treated with aureomycin were afebrile at the end of 48 hours of therapy. No patient receiving the placebo was febrile after the third day and no patient receiving aureomycin was febrile  $\frac{1}{2}$  days. One patient treated with penicillin was febrile over 72 hours occurred in a few patients regardless of therapy (table 1).

TABLE I. Duration of temperature elevations ( $92.5^{\circ} F.$ , or over)

Days of treatment	Group 1						Group 2					
	Penicillin		Placebo		Aureomycin		Penicillin		Placebo		Tetramycin	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Less than 1	11	46	7	32	8	35	5	29	8	50	9	50
1	6	25	10	45	6	26	5	29	2	13	5	28
2	4	17	3	14	5	22	1	6	1	6	2	11
3	1	4	2	9	3	13	1	6	2	13	1	5.5
4	1	4			1	4	2	12	1	6	1	5.5
5							1	6	1	6		
6	1	4										
7							2	12				
8												
9												
10												
Total	24		22		23		17		16		18	

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TABLE 2. Duration of pulmonary infiltration on roentgenograms after hospitalization

Weeks	Group 1				Group 2			
	Penicillin		Placebo		Penicillin		Placebo	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	3	11	3	10	6	57	6	24
2	8	28	10	34	32	57	10	40
3	28	11	4	14	8	26	3	12
4	3	11	4	14	10	7	13	56
5	2	7	3	10	1	3	6	27
6	1	4	1	3	1	3	1	4
7	2	7	1	3	1	3	1	4
Over 7	1	4	4	14	2	6	1	4
Total	28	29	1	6	23	25	28	28

After hospitalization, the rate of clearing of the pulmonary infiltration on roentgenograms was closely comparable on all treatment schedules. Sixty-seven percent of those receiving penicillin, 58 percent of those receiving the placebo, and 64 percent of those receiving aureomycin had resolution of their pulmonary infiltrations at the end of 3 weeks. From 85 to 90 percent of all patients had clearing of their pulmonary infiltrations by the end of 6 weeks regardless of therapy. The remainder of the patients took about 2 months for their roentgenograms to return to normal (table 2).

*Group 2.* Sixty-four percent of patients receiving penicillin, 69 percent of those receiving the placebo, and 89 percent of those receiving terramycin were afebrile after 48 hours. After 4 days of therapy, 82 percent of the penicillin-treated patients, 88 percent of the placebo-treated patients, and all of the terramycin-treated patients were afebrile.

By the end of 2 weeks of hospitalization, 79 percent of those receiving penicillin, 64 percent of those receiving the placebo, and 86 percent of those receiving terramycin had resolution of their pulmonary infiltration on roentgenographic study. At the end of 3 weeks, 92 percent of those receiving penicillin, 88 percent of those treated with a placebo, and all of those treated with terramycin had complete resolution. One patient receiving the placebo had persistence of the pulmonary infiltration after 6 weeks of hospitalization.

*Complications* were uncommon. Pleural effusions occurred in 2 patients treated with penicillin. In 1 resorption was spontaneous and in the other a diagnostic paracentesis was performed. One patient receiving the placebo developed a pansinusitis and had to be treated with antibiotics.

### STATISTICAL ANALYSIS

The results were tested statistically. Those results in which there were less than 30 patients in the smallest group were tested by the chi square method. When the numbers were larger than 30, the results were evaluated by testing for the standard error. There was no significant variation in the rapidity with which the patients in group 1 became afebrile and the rapidity with which their pulmonary infiltrations resolved (table 3). In group 2 there was greater variation. Through the end of the third day there was no significant difference in the rapidity with which the patients became afebrile, but the variation after the fifth day of therapy, when all patients treated with terramycin were afebrile, was significant. Comparison of the rapidity with which the pulmonary infiltrations resolved was of borderline significance.

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		Medication					
		Penicillin compared with aureomycin	Placebo compared with aureomycin	Penicillin compared with tetracycline	Placebo compared with tetracycline	Penicillin compared with aureomycin or tetracycline	Placebo compared with aureomycin or tetracycline
Effect on the duration of temperature elevation after 5 days of therapy	Chance variation	chance variation	chance variation	1.0	13.0	3.8	7.9
Effect on the rate of resolution of the pulmonary infiltration	52.0*	19.0*	14.7**	1.7**	37.0**	17.0**	

\*Based on 5 weeks' observation.  
\*\*Based on 3 weeks' observation.

Because the patients treated with aureomycin and those treated with terramycin had almost identical responses in their febrile course, the 2 groups were combined and then re-evaluated (table 4). It was definitely demonstrated that aureomycin and terramycin significantly shortened the febrile period in the few patients who would have been febrile beyond the fifth day of hospitalization. In combined series, we could demonstrate no significant effect with any treatment schedule on the rate of pulmonary resolution (table 5).

TABLE 4. Duration of temperature elevation (over 99.5° F.) in groups 1 and 2 combined

Days of treatment	Penicillin		Placebo		Aureomycin or terramycin	
	Number	Percent	Number	Percent	Number	Percent
Less than 1						
1	16	39	15	40	17	41
2	11	27	12	31	11	27
3	5	12	4	10	7	17
4	2	5	4	10	4	10
5	3	7	1	3	2	5
6	1	2	1	3		
7	1	2				
8	2	5				
9						
10			1	3		
Total	41		38		41	

## DISCUSSION

The numbers of patients in our treatment schedules were small and if those who were mildly ill were excluded, the number of patients whose course was significant becomes even smaller. We believe, however, that we can reach some definite conclusions in view of the fact that we were dealing only with young men who had been in good physical condition prior to their acute illness.

There was no significant variation within the 2 groups when evaluated separately, but when they were combined, it became evident that the broad spectrum antibiotics exerted some effect because no patient receiving these agents was febrile after 5 days of therapy. On the other hand from 6 to 9 percent of those receiving penicillin or a placebo were febrile after this period of time. Neither aureomycin nor terramycin, however, had any significant effect on the rapidity of pulmonary resolution. These pa-

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tients who were ill during the warm spring weather had much more rapid clearing of their pulmonary infiltrations than those who were ill during the winter regardless of therapy.

TABLE 5. Duration of pulmonary infiltration in groups 1 and 2 combined

Weeks	Penicillin		Placebo		Aureomycin or Terramycin	
	Number	Percent	Number	Percent	Number	Percent
1	8	16	9	17	14	24
2	21	40	20	37	22	37
3	11	22	10	19	12	20
4	3	6	5	9	7	12
5	4	8	4	7	1	2
6	1	2	1	2		
7	2	4	5	9	2	3
Over 7	1	2			1	2
Total	51	54			59	

## SUMMARY

Abacterial pneumonia, as it commonly occurs, is variable in its course, ranging in severity from an asymptomatic pulmonary infiltration to a severe prostrating illness. It is usually a benign, self-limited disease. Its course is definitely influenced by the season of the year. In view of those facts, it is difficult to evaluate the efficacy of any therapeutic agents. In the series of patients studied here, aureomycin and terramycin had no effect on the rapidity of clearing of the pulmonary infiltration and the patients got well at the same rate of speed whether or without antibiotic therapy, but aureomycin and terramycin appeared to prevent the prolonged febrile course that occurred in the remaining 10 percent.

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*Gynecologic and Obstetric Pathology With Clinical and Endocrine Relations*, by Emil Novak, A. B., M. D., D. Sc. (Hon.), Trinity College, Dublin, Tulane, F. A. C. S., F. R. C. O. G. (Hon.), Assistant Professor Emeritus of Gynecology, Johns Hopkins Medical School; Gynecologist, Bon Secours and St. Agnes Hospitals, Baltimore, Md.; Fellow and Past President, American Gynecological Society. 3d edition. 595 pages; 630 illustrations, 19 in color. W. B. Saunders Co., Philadelphia, Pa., publisher, 1952.

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*Architectural Principles in Orthopaedics*, by H. A. Brittain, O. B. E., M. A., M. Ch., F. R. C. S., Director, Orthopaedic Services, Norfolk and Norwich Group of Hospitals; Hunterian Professor, Royal College of Surgeons England, et cetera. Foreword by Sir Harry Platt, M. D., M. S., F. R. C. S. F. A. C. S. (Hon.), Emeritus Professor of Orthopaedic Surgery, University of Manchester; President of the International Orthopaedic Society; Consultant Adviser in Orthopaedics, Ministry of Health. 2d edition. 196 pages; illustrated. Williams & Wilkins Co., Baltimore, Md., publisher, 1952.

# SMALLPOX

Twenty-one Cases in United Nations Personnel, Korea

SIGURD E. SIVERTSON, M. D. (1)

JULIAN B. HYMAN, Lieutenant, MC, U. S. A. (2)

FROM October 1950 to April 1951 twenty-one patients with smallpox were seen at a station hospital in Korea.

## CLINICAL OBSERVATIONS

The 21 patients varied in age from 4½ months to 54 years. Eighteen of the patients were between 18 and 25 years of age. All were men except for a female dependent, 4½ months old. Thirteen were Americans. Because of the many terminologies confusing the classification of smallpox, the patients were divided into 4 groups: (1) those showing lesions which had run together or coalesced on the face, or on the face and elsewhere on the body, were diagnosed confluent smallpox; (2) those in whom the pox remained individually distinct and the last crust was lost during the third or fourth week of illness were diagnosed discrete smallpox; (3) when the duration of illness was 10 days and the rash easily confused with chickenpox, a diagnosis of varioloid smallpox or alastrim was made; and (4) when bleeding occurred at any stage of the disease a diagnosis of hemorrhagic smallpox was made. The observations are summarized in table 1.

*Confluent smallpox.* The 8 patients who did not have a smallpox scar stated that "vaccinations never worked" on them. One of the 8 had a vaccinoid reaction of 8 days' duration at the time his smallpox developed. The other 3 were Turks, admitted late in the course of the disease when confluent pox prevented visualization of scars and language barriers made immunization impossible unobtainable.

Before the rash developed, chills, fever, headache, backache, nausea, vomiting, and abdominal pain were present for 4 or 5 days in most of these patients, but in 1 they lasted for 8 days. The rash began as a maculopapular eruption often appearing overnight on the face. A prodromal generalized hypotonia was confused with measles and scarlet fever in 1 patient. In another, the

(1) Formerly Chief of Infectious Disease, Station Hospital, Korea; presently a Fellow in Medicine at Mayo Clinic, Rochester, Minn.  
U. S. Naval Hospital, St. Albans, N. Y.

TABLE I. Clinical data on 21 patients with smallpox

Group	Number	Childhood scar		History of from 1 to 4 unsuccessful vaccinations in preceding 8 months	Extensive pharyngeal pox	Lymphadenopathy	Last crust gone after
		Absent	Present				
Confluent	11	8*	0	8*	7	11	28-42 days
Discrete	7	4	3	6	0	7	20-28 days
Varioloid	2	0	2	2	0	0	10 days
Hemorrhagic	1	-	-	**	0	1	***
Total	21	12	5	16	7	19	

\* History was unobtainable from the other 3 patients.

\*\* History was unobtainable from this patient.

\*\*\* Patient died on sixth day, no crusts were present.

papules appeared initially about old psoriatic lesions of the elbows. Seven in this group developed extensive oral and pharyngeal pox, such that mastication and deglutition were not possible. All of these died, whereas, the others who were able to eat and drink lived. Axillary lymphadenopathy was found in every patient, and 2 also had prominent cervical nodes. The nodes were soft, slightly tender, discrete, freely movable, and varied in size from that of a pea to that of a small plum.

Therapy consisted of symptomatic and supportive measures, and antibiotics. One patient was given 1 gram of aureomycin on admission, followed by 500 mg. every 6 hours. Even though no pustular stage was seen, this patient's temperature continued to rise and he died. Another who was given the dosage of aureomycin, plus 300,000 units of procaine penicillin in aluminum monostearate intramuscularly daily survived. No pustular stage was seen in this patient. Two patients were given 1 grm of chloromycetin on admission and 500 mg. every 6 hours plus ponicillin; 1 died and 1 lived. Again no pustular stage was seen. Of 4 patients who received ponicillin alone, 1 died. The 3 Turks, admitted late in the course of the illness, showed a minimal pustular stage before death, but did not receive penicillin until 2 or 3 days before they died.

*Discrete smallpox.* Of 7 patients with discrete smallpox, 3 had childhood smallpox scars and subsequent vaccinations had never been successful. The other 4 did not have scars and, although they had been vaccinated at least twice in the preceding 8 months, none were successful. Six of the patients had had fever for 4 or 5 days and the seventh, 8 days before a skin eruption appeared. The rash was typical in onset and progression. Five showed a few oral and pharyngeal pox which did not interfere with swallowing. Axillary lymphadenopathy was found in all of these patients and 2 of them also showed cervical adenopathy. The penicillin schedule previously described was routinely administered and half the adult dose was given to the infant. No pustular stage with rise in temperature occurred. Those started on antibiotic therapy late in the vesicular stage developed a few pustules.

*Varioloid smallpox.* In both of 2 patients with varioloid smallpox, vaccinations had been unsuccessful since the childhood "take." Pre-eruptive symptoms continued for 5 days in both patients. Neither of them was toxic when admitted and the rash could not be differentiated from that of chickenpox. No mucosal lesions or adenopathy were seen. One patient was diagnosed by culturing the virus from vesicular fluid on the chorio-allantoic membrane of a developing chick embryo. Intradermal inoculation of a rabbit and Paul's test were positive also. The other was

diagnosed clinically by the progression of the rash and particularly by the peripheral blood manifestations. Therapy was no problem and penicillin was given as previously described.

*Hemorrhagic smallpox.* Although the virus was not cultured from the one patient with hemorrhagic smallpox, the demonstration of Guarnieri's bodies in the skin confirmed the diagnosis. The patient, a 54-year-old sailor, became ill with headache, nausea, vomiting, and abdominal pain about 5 days before admission. Because he was confused and apathetic a detailed history could not be obtained. He was afebrile and had a peculiarly red complexion which had started on his thighs 2 days before admission. The redness was produced by diffuse erythema over his face, arms, trunk, and to a lesser extent on his legs. Generalized petechial, purpuric and ecchymotic lesions were also present, but were most marked in his lower extremities. They seemed to increase in number and intensity during the examination. His liver and spleen were questionably enlarged. He was given a blood transfusion on the evening of admission and bled profusely about the needle. Because of this severe bleeding tendency, all parenteral medications were stopped. Aureomycin was given by mouth. On the following morning, his respirations increased to 40 per minute, rales filled both lung bases, his erythema became more intense, and the purpura progressed and coalesced. He became irrational and cyanotic. Twenty-four hours after admission on the sixth day of his illness, he died. His hemoglobin was 16; his erythrocyte count was 4,210,000; his hematocrit was 49 percent; his leukocyte count was 25,150 with 58 percent lymphocytes, 28 percent neutrophils, 7 percent eosinophils, 2 percent eosinophils, 2 percent myelocytes, 2 percent blast cells, and 1 percent eosinophilic myelocytes. He had 9 nucleated red blood cells per 100 leukocytes and a platelet count of 33,680. His bleeding time (Duke) was over 1 hour. His sedimentation rate (Wintrobe) was 16. His nonprotein nitrogen was 114 and his creatinine was 5.1. His bone marrow showed a myeloid hyperplasia with a shift to the left. The predominating cells were myelocytes. No foreign cells were seen.

At autopsy, the skin showed diffuse generalized petechias and ecchymoses which were most marked in the lower extremities. Diffuse conjunctival hemorrhages were present bilaterally. The same type of hemorrhagic lesions were seen in small numbers throughout the abdominal subcutaneous tissues, viscera, and retroperitoneal tissues. The spleen weighed 250 grams and its cut surface was beefy red.

Microscopically, the spleen showed marked congestion and great diminution in the size of the lymphoid follicles. The follicle framework remained intact, but most of the lymphocytes had

disappeared. Numerous eosinophils and polymorphonucleocytes were interspersed in the follicular areas. Large numbers of granulocytes including young immature forms and many nucleated red blood cells were seen throughout the pulp and sinusoids. The entire spleen showed evidence of advanced necrosis, manifested by pyknotic nuclei and large numbers of fragmented nuclei.

The general architecture of the lymph nodes was normal, but the follicles were represented by a few small foci and the remainder of the node consisted of framework. Large mononuclear cells with lymphoeytoid nuclei and abundant basophilic cytoplasm eosinophilic, and granuloeytes were scattered throughout the framework and filled the sinusoids. Multiple sections of the skin prepared with Giemsa's stains showed round to oval homogeneous eosinophilic bodies surrounded by a halo in the cytoplasm of the epidermal cells. These were interpreted as Guarnieri's bodies.

*Outcome.* Eight of the 21 patients (38 percent) died. Four of these, in whom the date of onset could be accurately determined, died on the fourteenth day of the disease.

#### HEMATOLOGIC OBSERVATIONS

Hematologic studies consisted of periodic hemoglobin determinations, total leukocyte counts, and differential counts. Postmortem bone marrow examinations were made immediately in 5 patients. Most of the patients experienced a drop in hemoglobin to levels as low as 10 grams around the fourteenth day of illness, although some did not experience any significant fall. There was a mild amount of polychromatophilic in the blood of those patients who did have a drop in hemoglobin. Eight patients had nucleated red blood cells during the course of their disease.

Table 2 shows the course of the leukocytic findings in various stages of the disease. During the first 8 days of illness, a leukocytosis due to an increase in neutrophils was noted. This leukocytosis continued from the eighth to the thirteenth day of illness with a relative lymphocytosis producing an equal distribution between lymphocytes and neutrophils. During the critical stage of the disease, about the fourteenth day of illness, and an absolute lymphocytosis prevailed, the lymphocytes increased when the vesicular stage prevailed. This lymphocytosis and leukocytosis in some patients persisted as late as the thirtieth day of the disease. In others, the leukocytic findings became normal sooner. The patients showing an absolute lymphocytosis or a rising lymphocyte count at the critical stage usually recovered, but those failing to show this or showing a decrease in lymphocytes died. The total leukocyte count ranged from 2,500 to 32,800. Four patients in the series did not have a leukocytosis during the acute phase of the disease.

Qualitative changes occurred in both the myelocytic and lymphocytic series. Twelve of the 21 patients had a shift to the left in the myelocytic series with the presence of myelocytes and frequently younger cells. In all patients the lymphocytes showed changes characterized by extreme variations in size, degree of staining of the nucleus and cytoplasm, and azurophilic granulation of the cytoplasm.

TABLE 2. Course of leukocytic findings in smallpox

	1-8 days	9-13 days	14th day or later
Recoveries	Leukocytosis with increased polymorphonuclears	Leukocytosis with slightly increased lymphocytes	Leukocytosis with lymphocytosis
Deaths		Leukocytosis with increased polymorphonuclears	Leukocytosis with increased polymorphonuclears

The bone marrow of the 5 patients studied at autopsy revealed a myeloid hyperplasia with a pronounced shift to the left. The predominant cell was a myelocyte or premyelocyte.

#### PATHOLOGIC OBSERVATIONS

An autopsy was performed on 4 of those who died. The most revealing observation was a generalized lymphadenopathy. These changes grossly resembled the findings associated with lymphoma. Microscopically, the lymph nodes were hyperplastic in 3 cases and in the fourth had the appearance of lymphadenitis. Guarnieri's bodies of the skin were seen in 3 cases. Surprisingly enough, 2 showed no pneumonia grossly or microscopically. Minimal localized pneumonia was seen in a third. In the fourth, who had had no antimicrobial therapy until 2 days before death, an overwhelming bronchopneumonia was present.

#### DISCUSSION

All patients admitted to the station hospital were routinely vaccinated against smallpox. Among this group of several thousand, there were a few who, despite repeated daily vaccinations with different lots of vaccine, failed to show a satisfactory response. They did not have a childhood scar and left the impression that there are some persons who may never react to vaccination. In most of these patients, however, a successful take was obtained.

The recognition of smallpox during the prodromal stage and differentiation between the initial rash and that of chickenpox have long been a problem to the clinician. Sometimes it is impossible, except by recovering the virus from vesicular fluid. Certain observations in these cases proved helpful.

In an endemic region, a vaccination history is most important. The disease strikes those who have not had a successful take, despite many vaccinations, or adults who have not had a successful vaccination since a primary vaccination reaction in childhood. Difficulty arose in differentiating a true immune reaction from a foreign protein response (3). Because several patients in this study showed recent immune reactions on their immunization records, the recording of "immune" as an immunization record was never taken at face value. Such a story in a patient with a sustained, toxic, unexplained, febrile illness should immediately place the physician on guard and prompt him to isolate the patient.

The presence of early lymphadenopathy, particularly axillary, lends further weight to the diagnosis of smallpox. Lymphadenopathy in chickenpox is also not uncommon, but in smallpox it seems to appear earlier, i. e., during the pre-eruptive period.

These points, together with the remarkable peripheral blood changes helped make the diagnosis of smallpox in 1 patient before a characteristic rash developed.

Differential criteria between the skin eruptions of chickenpox and smallpox can be found in most textbooks. The variability in the development stage of the lesions was indeed useful, but the great variation in size of the pox plus their wide erythematous margins proved most valuable in recognizing chickenpox.

Extensive oral, pharyngeal, and laryngeal mucosal lesions were ominous prognostic signs. The patients who were unable to eat or drink because of them, died despite the giving of fluids intravenously and subcutaneously.

A patient was considered noninfectious when the last crust disappeared. The soles of the feet were last to clear. At that time the patient was evacuated. Frequently, when a primary crust was picked off, minute bleeding and extravasation of serum formed a secondary crust, which, to the clinician seeing the case for the first time, led him to believe the patient still infectious. Day-to-day observation for this reason is essential in expediting evacuation.

(3) Benenson, A. S.: Immediate (so-called "immune") reaction to smallpox vaccination. J. A. M. A. 143: 1238-1240, Aug. 5, 1950.

Hemorrhagic manifestations of smallpox may occur in the pre-eruptive, vesicular, or pustular stage of the disease (4). In the patient herein described, purpuric lesions developed before a typical rash appeared and an erroneous diagnosis of idiopathic thrombocytopenic purpura was made.

The present day hematologic concept holds that in the prodromal stage a leukocytosis due to increased neutrophils exists; in the prepustular eruption, the differential hematologic findings return to normal and a leukopenia may appear; and in the pustular stage, an absolute polymorphonuclear leukocytosis develops. Observations in this study indicate that during the critical prepustular stage, occurring on the fourteenth day of illness, an absolute lymphocytosis occurs in the patients who recover and does not develop in those who die. This provides a valuable prognostic sign (5). Furthermore, qualitative changes in the neutrophils and more particularly the lymphocytes were observed early (in the pre-eruptive stage). This re-emphasizes their usefulness in early diagnosis (6).

In hemorrhagic smallpox, the blood shows a marked granulocytic change, leukocytosis, lymphocytosis, and thrombocytopenia as observed in our patient. It is significant that here is a virus infection, affecting all major blood components much like leukemia (4). With the advent of antibiotics, the course of smallpox has changed. No longer does the green, yellow malodorous pus form in quantities of about 5 liters per day (7). A classical pustular stage with its pyrexia was not seen in any of our patients. Aureomycin, chloramphenicol, and penicillin are all apparently effective in preventing it, but penicillin given intramuscularly is preferred, except in patients with hemorrhagic smallpox, in view of the dysphagia occurring with pharyngeal mucosal lesions.

There was no opportunity for a follow-up in this study. With the elimination of the pustular stage, it seems reasonable to assume that scarring might be greatly reduced.

Dramatic as these changes may be, smallpox is none the less deadly. Despite the apparent elimination of a secondary invader, a mortality rate of nearly 40 percent occurred in this series. The cause of death now is more problematical than when

(4) Snadel, J. E.: Smallpox and vaccination. In Rivers, T. M. (editor): *Viral and Rickettsial Infections of Man*. J. B. Lippincott Co., Philadelphia, Pa., 1948. Chap. 15, pp. 314-336.

(5) Unpublished data.

(6) Councilman, W. T.: Smallpox. In Osler, W. (editor) *Osler's Modern Medicine*, Vol. II. Lea Brothers & Co., Philadelphia, Pa., 1907. pp. 287-290.

(7) Schamberg, J. F., and Kolmer, J. A.: *Acute Infectious Diseases*, 2d edition. Lea & Febiger, Philadelphia, Pa., 1928. pp. 152-298.

bacterial invasion was a factor. The explanation may lie in a profound physiologic disturbance resulting from extensive skin destruction and transudation of fluids and electrolytes.

### SUMMARY

Smallpox attacks those who have never had a successful vaccination or who have not had a take since the primary vaccination reaction in childhood. Attention is called to the difficulty in differentiation between a true immune reaction and a foreign protein reaction. The hematologic changes are of diagnostic and prognostic value.

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# SITE FOR INTRAMUSCULAR INJECTION

ROBERT W. AUGUSTINE, Lieutenant Colonel, U. S. A. F. (MC) (1)  
W. E. LANDMESSER, Jr., Captain, U. S. A. F. (MC) (1)  
MERVEL V. PARKER, Captain, U. S. A. F. (MC) (1)  
OTIS L. VADEN, Captain, U. S. A. F. (MC) (1)

**A**LTHOUGH the gluteal muscles of the buttock are most often selected for intramuscular injections, this site is not the best available because (1) the area cannot be adequately exposed without turning the bed patient, (2) the buttock of the bed patient is often contaminated by feces, and (3) there is the possibility of damage to underlying nerves and blood vessels. The major objection to the use of the gluteal muscles as the site of choice for intramuscular injection is the possibility of damage to the sciatic nerve. This complication has been reported previously (2, 3), and we know of 3 patients with sciatic palsy resulting from gluteal injections. One recovered and one partially recovered but the third is unimproved.

Sciatic palsy may follow intramuscular injection when the medication is deposited intraneurally or because of careless and negligent insertion of the needle into improper portions of the muscles. The injection is often made into the general region of the hip with little regard for the underlying anatomic structures. The use of the brachium should be avoided because of the relatively small mass of muscle and the danger of injury to the axillary, radial, and ulnar nerves (2).

The best site for intramuscular injections is the lateral aspect of the thigh, the medication being injected into the mass of the vastus lateralis of the quadriceps femoris group (fig. 1). This site is not original with us. Our object is to call attention to it and emphasize its importance. Turner (4) was, as far as we have

(1) U. S. Air Force Hospital, Maxwell Air Force Base, Ala.

(2) Broadbent, T. R.; Odom, G. L.; and Woodhall, B.: Peripheral nerve injuries from administration of penicillin; report of 4 clinical cases. J. A. M. A. 140: 1008-1010, July 23, 1949.

(3) Woodhall, B.; Broadbent, T. R.; and Javer, J.: Neuropathology of antibiotic-induced peripheral nerve palsy. In Surgical Forum; Proceedings of the Forum Sessions, Thirty-Sixth Clinical Congress of the American College of Surgeons, Boston, Mass., Oct. 1950. T. B. Saunders Co., Philadelphia, Pa., 1951. pp. 394-399.

(4) Turner, G. C.: Site for intramuscular injections. (Letter to Editor of the Lancet) Lancet 199: 819, Oct. 16, 1920.

been able to ascertain, the first to advocate the use of the vastus lateralis. This site was subsequently recommended in response to a query addressed to the editor of the *British Medical Journal* (5); stressed again by Turner (6) in 1944 and recently by Krishna (7). These authors have unanimously favored the lateral aspect of the thigh over the gluteal region.

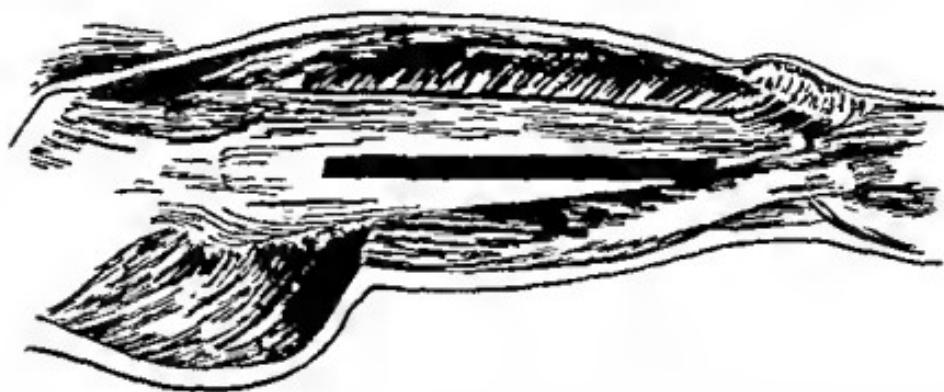


Figure 1. Lateral view of fascia and muscle mass of thigh showing favored site (blacked in) for intramuscular injection. (Adapted from *Manual of Surgical Anatomy*, Medical Departments, U. S. Army and U. S. Navy, 1918.)

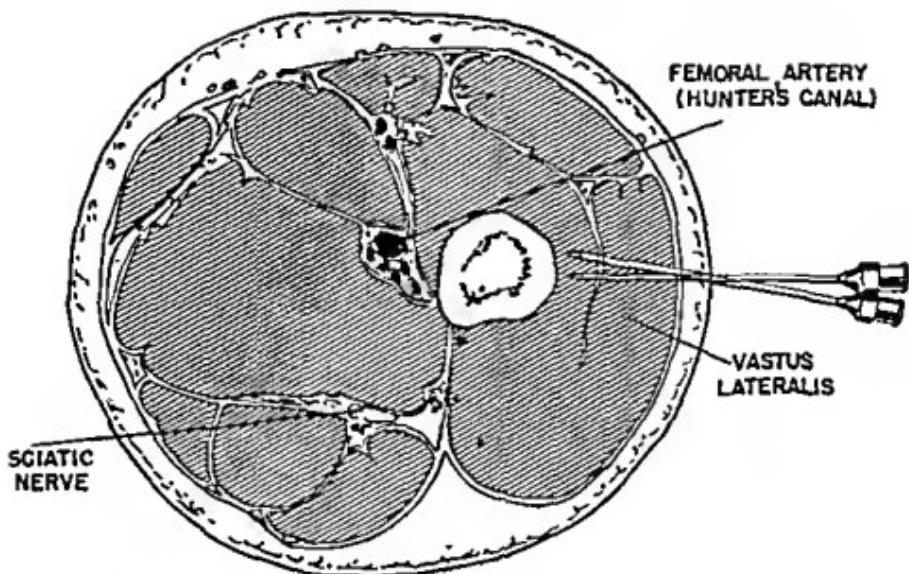
Physicians in this country have neglected the advantages of using this site for intramuscular therapy. We are not familiar with any reference to it in American medical literature. The recommended area is readily available in either the prone or supine patient; is large enough to permit repeated injections; and contains neither major nerves nor vessels (fig. 2).

The injections are made into the muscles of the thigh along a line extending from the greater trochanter above to the lateral femoral condyle below. Limiting this line by a handsbreadth above the knee and the same distance below the greater trochanter gives ample space for multiple injections placed 1 inch apart. With the patient sitting or lying supine, the needle is inserted parallel with the floor or directed slightly toward the anterior aspect of the thigh (fig. 3). A fast harpoon thrust will sink the needle to the hub painlessly. For adults, a 1½-inch needle is used. Should the needle strike the femur, pain or tissue injury will be negligible. Aspiration must be attempted prior to injection to avoid intravascular deposition of the medication.

(5) Anonymous. Site for intramuscular injection. (Letters, Notes, and Answers) *Brit. M. J.* 1: 775, June 19, 1943.

(6) Turner, G. G.: *Brit. M. J.*, July 8, 1944. Cited in footnote reference (7).

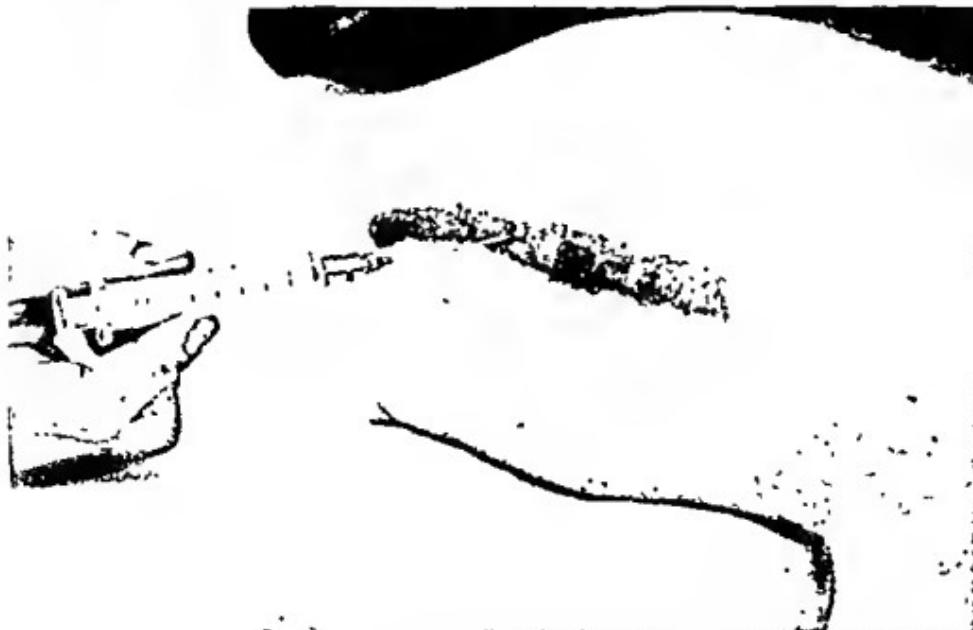
(7) Krishna, G.: Intramuscular therapy. *Antiseptic* 45: 703-710, Oct. 1948.



*Figure 2. Cross section of middle third of the thigh showing muscle mass, vital structures, and optimum positions of needle. (Adapted from Manual of Surgical Anatomy, Medical Departments, U. S. Army and U. S. Navy, 1918.)*

In children, because penetration to the sciatic nerve or great vessels is possible, a shorter needle should be used.

Hunter's canal, lying in the medial thigh, is not reached unless the injection is made very carelessly and too far posteriorly



*Figure 3. Oblique view of external aspect of thigh showing angle of syringe for injection. Black line indicates area which may be used for injections.*

Dark-field microscopic examination revealed large numbers of *Borrelia vincenti*, lesser numbers of *F. plauti-vincenti*, and what appeared to be scattered diplococci. A stained smear revealed these organisms and large clusters of pus cells.

### TREATMENT

Topical application has been employed by Rothner et al. (3), using penicillin, and by Goldman and Bloom (4), using aureomycin. I used a mixture of aureomycin and terramycin in a large number of patients prior to its use on those herein reported with gratifying results. The lesions are forcibly sprayed with a three-quarter strength solution of hydrogen peroxide, dried gently by means of the air blast, and isolated by blocking with cotton rolls. A paste of fairly heavy consistency is made by mixing 50 mg. of aureomycin and 250 mg. of terramycin with several drops of distilled sterile water. This is applied generously to the lesions with a broad-bladed plastic instrument, care being taken to force the paste into the crevices surrounding the necks of the teeth and the interdental spaces. The paste is allowed to remain in place for at least 20 minutes. At the expiration of this time the cotton rolls are removed and the patient allowed to flush the mouth with ordinary tap water. He is instructed to avoid transmitting the disease to others, to discard the present toothbrush, to take a bland diet, and to return to the dental clinic on the following morning for further treatment.

The 5 patients with fusospirochetal stomatitis concerned in this report returned on the following day with a complete remission of subjective symptoms. The gray slough had almost completely disappeared and the angry appearance of the tissues had lessened. The local hemorrhagic tendencies persisted. Improvement was so dramatic, however, that the removal of secondary causes could be undertaken immediately. Bacteriologic smears revealed a marked decrease in the number of causative organisms. Follow-up treatments consisted of continued applications of the aureomycin-terramycin pack, elimination of calculus and overhanging restorations, and instruction in proper tooth brushing technic.

(3) Rothner, J. T.; Cobe, H. M.; Rosenthal, S. L.; and Baillie, J.: Adhesive penicillin ointment for topical application. *J. Dent. Research* 28: 544-548, Dec. 1949.

(4) Goldman, H. M., and Bloom, J.: Topical application of aureomycin for treatment of acute phase of necrotizing gingivitis (Vincent's infection). *Oral Surg.* 3: 1148-1150, Sept. 1950.

## CONCLUSIONS

The therapeutic value of an aureomycin-terramycin mixture is extremely efficacious in the treatment of fusospirochetal stomatitis. It is easy to apply. The only disadvantage is the high cost of these drugs.

**ADDENDUM:** Excellent results have also been obtained by using the aureomycin-terramycin mixture incorporated with butyn sulfate-metaphen ointment and iodoform gauze in the treatment of the so-called dry socket.

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- 1952 Year Book of Obstetrics and Gynecology (July 1951-June 1952), edited by J. P. Greenbill, B. S., M. D., F. A. C. S., Professor of Gynecology, Cook County Graduate School of Medicine; Attending Gynecologist, Cook County Hospital; Attending Obstetrician and Gynecologist, Michael Reese Hospital; Associate Staff, Chicago Lying-in Hospital; Author of *Office Gynecology, Obstetrics in General Practice and Principles and Practice of Obstetrics*. 575 pages; illustrated. The Year Book Publishers, Inc., Chicago, Ill., 1952. Price \$5.50.
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**Pharmacology and Therapeutics**, by *Charles Solomon*, M. D., F. A. C. P., Lecturer in Medicine, State University, College of Medicine, New York City; Attending Physician, Jewish Hospital of Brooklyn; Attending Physician, Jewish Sanitarium and Hospital for Chronic Diseases, Lecturer in Pharmacology and Therapeutics, School of Nursing, Jewish Hospital; Director of Graduate Course in Applied Pharmacology and Therapeutics, Brooklyn College of Pharmacy, with the collaboration of *Elizabeth S. Gill*, B. S., R. N., Instructor in Nursing, Department of Nursing, Faculty of Medicine, Columbia University, Presbyterian Hospital School of Nursing. 6th edition. 656 pages; illustrated. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1952.

**Ophthalmic Plastic Surgery**, by *Sidney A. Fox*, M. S. (Ophth.), M. D., F. A. C. S., Assistant Clinical Professor of Ophthalmology, New York University Post-Graduate Medical School; Attending Ophthalmologist, Goldwater Memorial and Bronx Veterans Administration Hospitals; Associate Ophthalmologist, Hospital for Joint Diseases; Assistant Surgeon Ophthalmologist, Bellevue Hospital, New York. 290 pages; illustrated. Grune & Stratton, Inc., New York, N. Y., publishers, 1952. Price \$15.

**Physiological Bases of Gynecology and Obstetrics**, by *S. R. M. Reynolds*, M. A., Ph. D., D. Sc., Dr. honoris causa, Staff Member, Physiologist, Department of Embryology, Carnegie Institution of Washington, Lecturer in Obstetrics, The Johns Hopkins Medical School, Baltimore, Md.; Professor honoris causa, Facultad de Medicina, Universidad de la Republica Oriental del Uruguay, Montevideo, Uruguay. 153 pages. Charles C Thomas, Publisher, Springfield, Ill., 1952. Price \$5.50.

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**The Newer Knowledge of Hygiene in Diet**, by *J. Sim Wallace*, M. D., C. M., D. Sc., L. D. S., F. D. S., R. C. S., Eng., F. A. C. D., Vice-President of the Food Education Society, Hon. Fellow Society of M. O. H.; (Neech Prize, 1928-29), Hon. Member B. D. A.; Past President of the Brit. Soc. for the Study of Orthodontics; Emeritus Lecturer in Preventive Dentistry, King's College Hospital; Formerly Dental Surgeon and Lecturer on Dental Surgery and Pathology, London Hospital; John Tomes Prize (1918-21) and Cartwright Medal and Prize (1920-25). R. C. S. Eng. 264 pages. Dental Items of Interest Publishing Co., Inc., Brooklyn, N. Y., publishers, 1952.

**Rheumatic Diseases, Diagnosis and Treatment**, by *Eugene F. Traut*, M. D., F. A. C. P., Associate (Rush) Clinical Professor of Medicine, University of Illinois, Attending Physician to the Cook County Hospital and to the West Suburban Hospital, Oak Park, Ill., Associate Attending Physician to the Presbyterian Hospital of Chicago, Director of the Arthritis Clinic of Cook County Hospital; Lecturer on Arthritis to the Cook County Graduate School of Medicine, Member of the American Rheumatism Association. 942 pages; 192 illustrations. The C. V. Mosby Co., St. Louis, Mo., publisher, 1952.

**Textbook of Surgery**, edited by *H. F. Moseley*, M. A., D. M., M. Ch. (Oxon), F. A. C. S., F. R. C. S. (Eng.), F. R. C. S. (C), Assistant Professor of Surgery, McGill University, Associate Surgeon, Royal Victoria Hospital, Montreal, Canada. With foreword by *G. Gavin Miller*, M. D., C. M., M. Sc., F. R. C. S. (C), F. A. C. S., Chairman of the Surgical Department, McGill University, Surgeon-in-Chief, Royal Victoria Hospital, Montreal, Canada. 896 pages, 460 text illustrations and 46 color plates. The C. V. Mosby Co., St. Louis, Mo., publisher, 1952. Price \$15.

# LEADERSHIP AND THE INCIDENCE OF TRENCH FOOT

EUGENE R. INWOOD, *Colonel, MC, U. S. A.* (1)

**P**HYSICIANS new to the Army do not always appreciate the amount of assistance a properly oriented and enthusiastic commander can give them nor do they always see why it is the commanding officer's duty to make decisions on medical matters. A medical officer, however, receives his authority from the commander and acts for him in giving commands to nonmedical personnel (2). Actually, he is acting in a staff capacity as medical adviser and in much the same way as does the physician in civil life (3). In an epidemic of diphtheria, for instance, a civilian physician may see a real need to immunize all the children in his particular neighborhood so that his own children may continue their normal activities without undue risk, but he cannot carry out such a program unless each parent consents.

In the Army there is a close parallel. It is the commander who, subject to the regulations given him by the higher commanders and on the recommendations of his medical adviser, makes the medical decisions for all of his men (4). The Army physician, however, has other resources on which he may depend when he is unable to convince a commander of the need for his recommendations. The regulations may support him and also assist the commander in arriving at a decision. He may seek consultation with other medical officers and learn of new approaches, but he is not free to withdraw from the case. The medical officer may report a situation to the next larger unit surgeon who in turn may take such action as he considers necessary. This action may consist of an informal visit, with verbal suggestions being made, or it may be a formal inspection with a written recommendation to his own commander to exert pressure in carrying out the first medical officer's recommendations. In some instances the first medical officer, in his frustration and anxiety, may be unduly disturbed about a minor situation, or he may have forgotten some very valid argument which would be convincing.

(1) Neuropsychiatric Service, Walter Reed Army Hospital, Washington, D. C.

(2) Army Regulations, 600-20, paragraph 3c, 5 May 1950.

(3) Army Regulations, 40-10, paragraph 4b, 8 Feb. 1952.

(4) Saving Lives on the battlefield. Officer's Call 4: No. 4, p. 10, 1952.

Whether in the Army or in civil life, the physician does not have absolute authority. It is important, therefore, to consider the relationship between the medical officer and the commanding officer with respect to compulsory treatment and a program which experience has shown depends not only on the interest and enthusiasm of the medical officer and his staff, but also on the support and active co-operation of the commander. With good leadership and support, extensive medical programs can be carried out and the health of the troops protected. With poor leadership, the end result, regardless of the efforts of the physician and his staff, cannot be satisfactory.

The unit commander can be a bulwark of support in assisting the physician. It has been fully demonstrated that some things such as typhoid vaccination, malarial prophylaxis, and other preventive measures cannot be controlled without compulsory treatment, but there are many conditions which cannot be controlled by immunization and in which the prophylactic treatment is more involved. Such a condition is trench foot. In view of this fact it becomes pertinent to review the relation of leadership to the incidence of trench foot in combat units. This relationship is borne out by an incident which occurred in a combat division in the European Theater of Operations in the late winter of 1944 and the early spring of 1945. This experience shows how in one infantry division when the incidence of trench foot became abnormally high, the recommendations of the division surgeon were completely approved by the commander, and how in 2 regiments of the division the condition was successfully controlled, and in the third regiment was only partially controlled in spite of the efforts of the medical officers to carry out prophylactic treatment as directed.

In the fall of 1944, the division was alerted for overseas movement. The unit had been training for more than a year, but progress through the unit training stage had never been accomplished because individual replacements in all grades were constantly being transferred overseas. A short time before entering the staging area, a series of training inspections was carried out. During these inspections it was discovered that some of the new men were completely unaware of the difference between trench foot and athlete's foot. A series of pictures on trench foot in all its stages, with emphasis upon early detection and treatment, was shown to the entire command. When the unit left for overseas, every man knew what trench foot was and that it was a dangerous condition which, if neglected, could mean the loss of a foot. A few weeks later, however, when the 3 infantry regiments were in combat in France, with the temperature several degrees below freezing, men began reporting back with suspected trench foot. It became apparent then that overemphasis had been

placed on the early detection of the condition and that the earlier training which had dealt with prophylaxis had been forgotten.

On 14 January 1945, at a conference between the division surgeon and the corps surgeon, it was determined that something had to be done to control trench foot. After 22 days of combat, one regiment had had 41 cases; another, 172; and the third, 84. The methods of prophylaxis were reviewed and the following recommendations made:

1. All men who were constantly exposed to freezing weather were to take their shoes and socks off once each day and rub their feet for 10 minutes.

2. Each soldier was to be provided with an extra pair of socks to carry on his person between his undershirt and his O. D. shirt so that he would have available 1 dry pair for a daily change. An effort was to be made to send up clean socks each day with the rations, but if this became impossible each man would still have the extra pair of dried socks which he carried on him for emergency wear.

3. Unit leaders were to supervise such procedures and were to set an example by themselves complying.

4. Unit surgeons were to inspect the men being sent to the rear more carefully, evacuating only those who were definitely incapacitated. They were to visit all units down to platoons and give necessary instructions and advice. These visits were to be made as frequently as possible—preferably daily.

The plan was approved by the division commander and regimental commanders were asked to come to the command post that same day. The G4, present at the meeting, agreed to arrange for laundry service and to send clean socks along with the rations. The commanding general issued explicit instructions endorsing the plan and stressing the need for such a program. He emphasized the fact that the unit had to conserve the men it had, that replacements were in short supply and often were completely inexperienced.

Two of the regimental commanders were enthusiastic in their support. Following the general's remarks, the third regimental commander said that: (1) it was a good but impractical idea; (2) his men, only the day before, had captured 2 Germans while in the act of rubbing their feet; (3) his men were too busy looking for Germans to take the necessary time out; (4) his men would not carry wet socks next to them until they dried; they would not put on dirty socks; and he doubted if there were any clean ones available to be sent up with the rations.

unfortunately in doing so he has been repetitious in his description, so that at times it wearies the reader. This was probably done because the book is intended to be used as a reference for the therapy of a particular condition, and not for continuous reading.

The author's experience, both clinical and investigative, with the use of digitalis is presented in great detail. This portion of the book is highly recommended. Certain of his other ideas concerning therapy may not be accepted by most cardiologists. He still believes in the restriction of fluids with a low salt diet and is firmly convinced that strict bed rest is mandatory. He disregards the "armchair" treatment of congestive heart failure or the evil sequelae of bed rest.

The discussions of the treatment (including surgical methods) of rheumatic heart disease and congenital heart disease are sound and informative. Some cardiologists may not agree with the amount of penicillin recommended in the treatment of subacute bacterial endocarditis. Likewise, although the book is filled with the latest developments in the field, one finds that the use of benemid for the maintenance of higher penicillin levels is omitted, although carinamide is discussed.

The chapter on diseases which may have cardiac manifestations or simulate cardiac disease is magnificent for the orientation of the physician who is interested in cardiac diseases. The book will be most valuable to the general practitioner, for through its use he may gain from the experience of an outstanding authority, but it will be of only passing interest to the qualified cardiologist.—*Commander H. A. Lyons, MC, U. S. N.*

*Electrotherapy and Actinotherapy, A Textbook For Student Physiotherapists,*  
by E. B. Clayton, M. B., B. Ch. (Cantab.), Consulting Physician to the  
Physical Treatment Department, King's College Hospital, London.  
2d edition. 452 pages, illustrated. Published in the United States by  
Williams & Wilkins Co., Baltimore, Md., 1952. Price \$4.

The book is designed primarily for physiotherapy students and as such meets that need. It is divided into three main parts: Part I, which deals with electrotherapy; Part II, with actinotherapy; and Part III, treatments. Part I is subdivided into 17 chapters, the first being a clear and simple discussion of static electricity. The chapters on units and ionic theories and cells and cell batteries are well presented. The remainder of this part of the book is devoted to condensers, magnetism, meters, motors, currents, normal and denervated muscles, and diathermy. Part II is concerned with actinotherapy. Here the physics of infrared rays and ultraviolet light are explained along with their effects and techniques for use. A classification of the methods of treatment and a discussion of some of the common conditions that respond to these methods of treatment are presented in Part III.

—*Lt. Col. R. C. Psaki, MC, U. S. A.*

# STAB WOUND OF THE CEREBRUM

CHARLES R. REINERS, *Captain, MC, U. S. A.*

WILLIAM E. PHILIP, *First Lieutenant, MC, U. S. A.*

**B**ECAUSE of the unusual circumstances surrounding the occurrence of a stab wound of the cerebrum, its manifestations, and the patient's dramatic recovery, the case is believed to be of sufficient general interest to justify preliminary reporting.

## CASE REPORT

A 31-year-old sergeant presented himself on 2 January 1952 complaining of numbness of the right lower portion of his face and weakness and numbness of his right hand of 24 hours' duration. Questioning disclosed a head injury incurred at about 0500 hours on 1 January while at a New Year's celebration. He was aware of having been struck over the left side of his head, but had no knowledge of the instrument used. A friend who had been present volunteered that he thought the patient had been struck by a bottle. Although stunned for 5 or 10 minutes he had not lost consciousness or fallen to the floor, but had immediately lost the ability to move his right thumb and index finger. He remembered concentrating very hard immediately after the injury in an effort to make these movements. Following the episode he returned to the barracks and slept soundly until late in the afternoon. On awakening he noted persistence of the weakness of his right thumb and index finger as well as numbness of these fingers and the right side of his face. Late that day he was seen in his unit dispensary complaining of a headache and hang-over and he received symptomatic treatment. He returned once again to his barracks and slept until the morning of 2 January, when he noted extension of the numbness to the other fingers, palm, and dorsum of his right hand. Weakness was also present and his speech was now somewhat slurred. There was no weakness of his right leg.

Because of the progression of his symptoms he was referred to the 379th Evacuation Hospital where a careful history revealed that 13 years prior to admission he had incurred a skull fracture in an automobile accident for which he had been hospitalized for 1 month; and 9 years prior to admission he was hospitalized for 2 weeks with a possible skull fracture.

On admission he was alert and rational. A laceration 1.5 cm. long was observed over the left parietal region of his scalp.

His pupils were regular and reacted well to light, and the optic disks appeared normal. A lower right facial palsy and weakness of his right hand were definite. The sense of touch was present over the right lower portion of his face and hand, although diminished, and pain was barely perceived. No weakness of his right arm or right leg was noted, nor were any pathologic reflexes elicited. Roentgenograms of his skull (figs. 1 and 2) disclosed a small pocketknife blade penetrating his left parietal bone and entering the cortex in a posterior and medial direction. The distal broken end of the knife blade appeared to be flush with the outer table.

Clinically his signs progressed with increased facial palsy, slurring of speech, and weakness and numbness of his right hand causing him to knock articles off the bedside table when he attempted to grasp them. Sixty hours after the stabbing, using an endotracheal tube and pentothal anesthesia, an incision was made to the line of the laceration with excision of the lacerated skin edges. An adequate purchase could not be obtained on the broken edge of the knife blade and a burr hole was placed immediately adjacent to it. Bone was removed with a ronguer until a dirty, blackened blade (fig. 3) could be freed and extracted. All damaged bone was then removed and the lacerated dura opened widely. Two small fragments of driven bone and a small amount of necrotic cortical tissue were removed from the cortex. The wound was irrigated and closed.



Figure 1. Anteroposterior view of skull.



Figure 2. Lateral view of skull.

On the day of the operation he regained consciousness and voided, but catheterization was required on the first postoperative day and an indwelling catheter was required for 48 hours. Supplementary parenteral fluids were supplied only on the first postoperative day. Thereafter fluid intake was adequate. He was given 300,000 units of penicillin twice daily, 0.5 gram of streptomycin every 8 hours, and an injection of tetanus toxoid. From a high of 101° F. on the first postoperative day his temperature became normal on the fourth postoperative day and remained normal thereafter. Gradual improvement of his speech and right facial palsy occurred, becoming complete on the seventh postoperative day. The strength and sensation of his third, fourth, and fifth fingers quickly returned as did sensation of his hand. The power and co-ordination of his thumb and index finger returned slowly, despite his ability to perform all movements. He was unable to write or shave until 2 weeks after the operation. The acuity of pain and light touch sense remain diminished, but his proprioceptive sense was intact. When last heard from, 3 months after operation, he was asymptomatic, performing full duty, and had submitted an application for the grade of warrant officer.

#### DISCUSSION

Although no conclusions are as yet warranted, this patient demonstrated a gratifying defense against a potential infection.

despite the time interval between the introduction and extraction of the foreign body. Although the value of antibiotics is not to be underestimated, we believe that emphasis should be placed on adequate débridement, particularly of indrawn bone fragments because such fragments are found in a large percent of



Figure 3. Pocketknife blade, 1½ inches long, removed at operation.

brain abscesses following penetrating wounds of the skull. The recovery of function that followed removal of the irritating stimulus, the absorption of blood clots, and the subsidence of edema were equally gratifying. Granted that sequelas may persist in this patient because of the severance of pathways in the posterior limb of the internal capsule, the fact that both motor function and sensation in the thumb and index fingers are grossly intact, though diminished, favors an optimistic prognosis.

BOOK REVIEW

**Brain Mechanisms in Coronary Disease, Causation, Treatment, and Prevention,** by N. E. Ischblondsky, M. D., Author of *Brain and Behaviour*; *Protomotherapy in Treatment and Prevention*; *Der Bedingte Reflex und Seine Bedeutung*; *Physiologische Grundlagen der Tiefenpsychologie*, et cetera. With Two Appendices: 1. From the Conditioned Reflex to the Science of Brain Dynamics. Paper delivered at the XVIIIth International Congress of Physiology. 2. *Reflexologic Bases of Personality*. Paper delivered at the Ninety-Sixth Annual Meeting of the American Psychiatric Association. 171 pages, illustrated. Henry Kumpf, London, England, publisher. 1952.

Dr. Ischlondsky has written a most stimulating and informative monograph from a physiologic point of view. He stresses that at the basis of all behavioral reactions there is a mobile equilibrium between the two fundamental processes of the nervous system—excitation and inhibition. He clearly explains, documents, and classifies the ideas and a definite contribution his patient. I would recommend this book enthusiastically to all physicians, regardless of specialty.

—Commander L. S. Hadley, MC, U. S. N.

# THE RELATION OF HYPERTENSION TO ARTERIAL ANEURYSMS OF THE BRAIN

BOYD K. BLACK, Lieutenant Commander, MC, U. S. N. (1)

SAMUEL P. HICKS, M. D. (2)

THE nature and origin of aneurysms of the arteries of the brain which are not obviously inflammatory have been the subject of many studies, but the cause of this not uncommon lesion has remained obscure. Although the concept that the principal lesion predisposing to aneurysm is a congenital defect in the muscular layer of a cerebral artery has been widely held, the trend has been to consider acquired lesions of the intimal elastic tissue as very important. The observations that medial defects are fairly frequent in normal cerebral arteries and that aneurysms are virtually absent in infants and children have been cited in support of this. The possible role of high blood pressure in producing these lesions has received some attention but the matter has remained controversial. It is useful, therefore, to note briefly some of the studies that bear on this problem of acquired disease, especially as they relate to hypertension and its associated cardiovascular lesions.

Fearnsides (3) considered the possible relation between "congenital" aneurysm and ventricular hypertrophy and concluded that although aneurysms were often found associated with cardiovascular disease, in many patients there was no evidence of hypertension clinically or at autopsy and that the degeneration of the cerebral arteries was no greater than would be expected in other subjects in the same age group in the general population. Abbott (4) found a high incidence of aneurysms in patients with coarctation of the aorta, but whether this is an association of 2 congenital vascular defects or the result of elevated blood pressure remains undetermined. Forbus (5), in a

(1) U. S. Naval Medical School, National Naval Medical Center, Bethesda, Md.

(2) The New England Deaconess Hospital and Harvard Medical School, Boston, Mass.

(3) Fearnsides, E. G.: Intracranial aneurysms. *Brain* 39: 224-296, Oct. 1916.

(4) Abbott, M. E.: Coarctation of aorta of adult type; statistical study and historical retrospect of 200 recorded cases with autopsy, of stenosis or obliteration of descending arch in subjects above age of 2 years. *Am. Heart J.* 32: 574-618, June 1928.

(5) Forbus, W. O.: On origin of military aneurysms of superficial cerebral arteries. *Bull. Johns Hopkins Hosp.* 47: 239-284, Nov. 1930.

study of the origin and mechanisms involved in the formation of "congenital" aneurysm, stated: "While the evidence at hand indicates that the muscularis defect constitutes the ground work for miliary aneurysm formation, there are convincing facts which cause us to regard the strength and persistency of the internal membrane as a factor of greatest significance in the development of anatomical aneurysms. While it is conceivable that small diverticula at the point of bifurcation may occur while the internal elastic membrane is still intact, it seems that no anatomical aneurysm can develop without disintegration of this membrane. In our study it has been possible to rule out all known causes of elastic tissue degeneration except the traumatic factor of over-extension due to blood pressure. This we regard as the essential cause of the internal elastic membrane disintegration which we have found constantly in the miliary aneurysm."

Glynn (6) subjected a number of human circles of Willis, obtained at autopsy, to a pressure of 600 mm. of mercury. As long as the elastica remained intact, the vessels withstood the pressure and neither congenital nor artificially induced defects in the media caused the vessel to give way. Richardson and Hyland (7) observed that structural bifurcation defects of the media predisposed to aneurysms but that there was an additional acquired lesion which acted by weakening the elastica. They emphasized that if it were merely intravascular pressure one would expect aneurysms to be much more common in patients with arterial hypertension. Magee (8) concluded from a clinical study of 150 patients that neither physiologic nor pathologic high blood pressure caused aneurysmal rupture. Carmichael (9) considered the interrelation of congenital and acquired anatomic disease and believed that probably both lesions need to be present to cause an aneurysm. He did not implicate hypertension. Such diversified opinions by students of the disease suggest that a single causative factor in the genesis of aneurysms will not be found.

In a recent clinicopathologic study of the cause of cerebral hemorrhage (10), the authors were impressed by an apparent frequent association of hypertension with cerebral arterial aneurysms in a small series of patients. As a result, we reviewed a series of

(6) Glynn, L. E. Medial defects in circle of Willis and their relation to aneurysm formation. *J. Path. & Bact.* 51: 213-222, Sept. 1940.

(7) Richardson, J. C., and Hyland, H. H. Intracranial aneurysms; clinical and pathological study of subarachnoid and intracerebral haemorrhage caused by berry aneurysms. *Medicine* 20: 1-83, Feb. 1941.

(8) Magee, C. G. Spontaneous subarachnoid haemorrhage; review of 150 cases. *Lancet* 2: 497-500, Oct. 23, 1943.

(9) Carmichael, R. Pathogenesis of non-inflammatory cerebral aneurysms. *J. Path. & Bact.* 62: 1-19, Jan. 1950.

(10) Hicks, S. P., and Black, B. K. Relation of cardiovascular disease to apoplexy; review of 155 cases with autopsy. *Am. Heart J.* 38: 528-536, Oct. 1949.

100 cases of aneurysm studied at autopsy in relation to hypertension and cardiovascular disease. The principal aims of the study were to learn how frequently cardiac hypertrophy, cerebral arteriosclerosis, and especially clinically recognized hypertension are associated with aneurysm and to attempt to evaluate the importance of these factors. Some of the unsolved problems in the pathogenesis of aneurysms are indicated.

### MATERIAL

The principal material used consisted of the autopsy reports of 100 patients who died with arterial aneurysms of the brain. In most instances bleeding from the aneurysm or frank rupture was the primary cause of death. The autopsies were performed in the section on Pathologic Anatomy of the Mayo Clinic, Rochester, Minn.; the U. S. Naval Medical School, National Naval Medical Center, Bethesda, Md.; the New England Deaconess Hospital, Boston, Mass.; and Gallinger Municipal Hospital, Washington, D. C. The age, sex, heart weight, body weight, ratio of heart to body weight, history of hypertension, and the presence of sclerosis of the arteries of the brain were determined. A history of a consistent diastolic pressure in excess of 90 was considered to be hypertensive. A heart-to-body weight ratio greater than 0.5 percent was considered to represent hypertrophy.

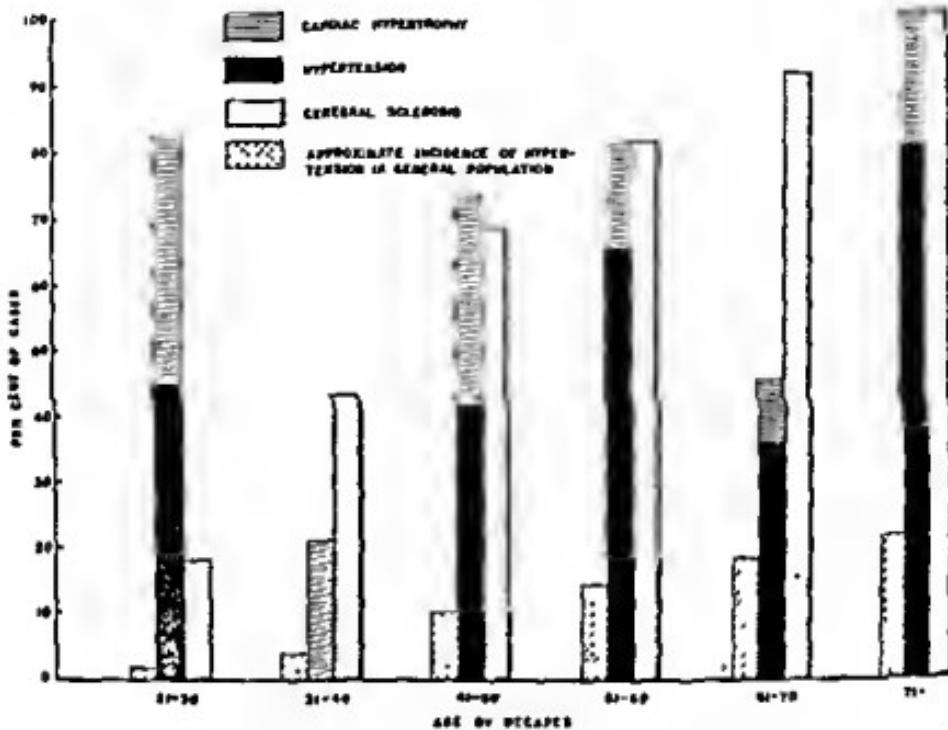
### RESULTS

The results are summarized in figure 1 and table 1. In figure 1 the percentage of patients who had cardiac hypertrophy, hypertension, and cerebral arteriosclerosis is compared with the incidence of hypertension in the general population (11). Arteriosclerosis of the brain shows a steady increase with age as would be expected. Cardiac hypertrophy and hypertension run a close parallel to each other. The relatively greater percentage of cardiac hypertrophy than hypertension in each group is a result, for the most part, of failure to obtain a history of hypertension in that some of these patients were seen only in the terminal stage of their illness or after death had occurred. The fact that cardiac hypertrophy may rarely occur in the absence of high blood pressure or other demonstrable cardiovascular disease may account for an isolated example.

What is more notable is that there is both a positive and a negative correlation between hypertension and aneurysm. That is, there is definitely a high incidence of hypertension in patients with aneurysms, suggesting a cause and effect relation, yet in some patients with aneurysm there is no high blood pressure. On

(11) Robinson, S. C., and Bruce, M.: Range of normal blood pressure; statistical and clinical study of 11,383 persons. *Arch. Int. Med.* 64: 409-444, Sept. 1939.

the one hand, in the fifth and sixth decades (54 patients) the incidence of hypertension is 56 percent, significantly above the maximum incidence for the general population in that age group, which according to Robinson and Brucer (11) ranges to a maximum of 11.7 percent in men and 12.9 percent in women. In the third decade, 45 percent of 11 patients with aneurysm had a definite history of hypertension as contrasted with an incidence of about



*Figure 1. The incidence of hypertension, cardiac hypertrophy, and cerebral arteriosclerosis in a series of 100 cases of cerebral aneurysm compared with the incidence of hypertension in the general population.*

2 percent in the general population for this group. On the other hand, a history of hypertension was absent in all of 14 patients in the fourth decade. Even assuming that the 3 patients who had cardiac hypertrophy had unrecognized high blood pressure, this incidence is far below that of other age groups in this series and shows that chronic hypertension cannot be an absolute requisite for the development of an aneurysm.

Because it is clear that hypertension is not a sine qua non of aneurysm formation, it can only be assumed that hypertension is frequently associated with aneurysm. There is, however, much evidence, as outlined above, that disease of the elastica is an essential factor in the genesis of aneurysms. It may be that the high blood pressure acting directly on the diseased vessels in some patients predisposes to aneurysm formation, especially if

TABLE 1. Summary of cardiovascular findings in 100 cases of aneurysm

Age (years)	Number	Cardiac hypertrophy	Hypertension	Cerebral arterio- sclerosis	Rupture of aneurysm	Ratio of women to men
21-30	11	9	5	2	10	2:9
31-40	14	3	0	6	12	10:4
41-50	22	16	9	15	17	9:13
51-60	32	26	21	26	26	15:17
61-70	11	5	4	10	9	5:6
Over 70	10	10	8	10	3	8:2
Total	100	69	47	69	77	49:51

tion, or a combination of both. A neurotic depression may occur at any age. An acute severe stress such as a "Dear John" letter (2) or the loss of loved ones may lead to a suicidal attempt or gesture in a predisposed person. This type of response is called a "reactive depression" or an "acute situational maladjustment." A general dissatisfaction with his position in life, unresolved frustrations, and various chronic emotional stresses are usually evident in the history of the chronically depressed patient. Although depressive features are present in most patients examined after a suicidal attempt or gesture, most patients exhibiting depressive features are not truly neurotically depressed. Perhaps only 1 or 2 out of 10 "suicidal" patients are properly so diagnosed. The others are primarily immature and inadequate persons. If a working diagnosis of neurotic depression is made, the examiner should not hesitate to hospitalize the patient, if necessary, for further treatment or observation. Usually a neurotically depressed person will show signs of psychomotor retardation and a depressed affect. He will not push for secondary gains with such threatening statements to the doctor as, "If you don't get me out of the service, I'll kill myself." Rather he is worried over a particular problem which he usually has held for many weeks or months and which he has been unable to resolve. In addition, there are marked feelings of guilt, inadequacy, and unworthiness.

*Mental deficiency.* Because they are usually screened out before entering the Army and especially before they go overseas, we did not see any severe mental defectives. Mental deficiency per se is not a predisposing cause for suicide, but a mental defective under stress is likely to develop psychotic behavior and/or make a suicidal gesture or attempt. The mental defective who manages to remain in the Army has usually attained a high enough mental level to be responsible for his actions. In most cases, however, mental deficiency is a mitigating factor in the disposition of the patient. These soldiers are recommended for administrative separation from the service and are not recommended for disciplinary punishment.

Most of the patients seen had made their suicidal attempts as a result of immaturity reactions. All these patients were returned to duty. Glass (3) briefly but adequately defined an immature soldier as "one characterized by a retarded emotional development which is not commensurate with chronological age and physical growth. The result is an individual who exhibits ineffectual, childish, or adolescent behavior when exposed to slight or moderate stress." Immaturity reactions include emotional in-

(2) Letter telling him his fiancée was married or in love with another man.

(3) Glass, A. J. Medical evaluation of the non-effective soldier. Surgeon's Circular Letter, FECOM & 74-79, Apr. 1951.

stability, passive-aggressive, passive-dependency, and aggressive reactions and alcoholism. Simple drunkenness is also included in this group.

A few of our patients were classified as having a pathologic (or psychopathic) personality. The inadequate, the schizoid, the anti-social, the asocial, and the sexually deviated personality are included. This type of patient not infrequently resorted to a suicidal gesture because of an acutely difficult situation following his own misconduct. Patients with either an immature or a pathologic personality are mentally responsible for their actions and therefore subject to administrative action—either punishment or discharge. All these men should be returned to duty. The recommendation sent with each man depends on the individual circumstances. The most important factor to be considered is the severity of the immature or pathologic personality.

When a "suicidal" patient is discharged to duty, a letter should be sent to his commanding officer. If the soldier is likely to reach his commanding officer before the letter, the commanding officer is notified by telephone or messenger of the soldier's mental status (responsibility) and the recommended disposition. This is followed by a letter written in nontechnical language. Such action makes it easy for the commanding officer to decide on the proper disposition.

### TYPICAL LETTERS

*Example 1.* This soldier has no mental illness. He was drunk at the time of his suicidal act and is very chagrined over his actions. He could give no reason for his act nor could any be found. It is unlikely that this act will recur. He was warned that this type of behavior may result in severe disciplinary action. It is suggested that no additional (or minimal) disciplinary action be taken because of the suicidal gesture.

*Example 2.* This soldier has an immature personality. Like a child who pounds his head against a wall when he does not get his way, this soldier harms himself. He does not really wish to commit suicide and his act is only an immature response to his frustration, resembling a temper tantrum. Because his basic personality has not changed, it is possible that he may again resort to acts of self-harm. Such acts could accidentally become serious and even lead to his death, but such a result is unlikely. He is mentally responsible for his actions. He is cleared by this section for any disciplinary action that is deemed advisable by his commanding officer.

*Example 3.* This soldier is an immature person who reacts to minimal stress in an emotionally unstable manner. He is responsi-

ble for his actions, but his personality is so immature that further gestures of a suicidal nature can be anticipated. It is doubtful whether these will be successful. Disciplinary action will not reform him. Psychiatric treatment is not indicated. His value to the service is nil. It is therefore recommended that he be discharged from the service as unadaptable (or unsuitable or unfit).

*Example 4.* This soldier is responsible for his actions and is therefore subject to disciplinary action. He is not mentally ill, but his personality is so defective (inadequate, alcoholic, or immature) that his further retention in the service is not advised. Although he has the capability of adjusting to military life, he will probably not adjust. It is therefore recommended that he be discharged from the service as undesirable.

*Example 5.* This soldier had an illness which led to his suicidal attempt. This condition has improved with treatment. He is being returned to duty. He will continue to receive treatment in the neuropsychiatric outpatient clinic at regular intervals. It is recommended that no disciplinary action be taken for his suicidal act.

### SUMMARY

Before an evaluation and disposition of a suicidal patient is made, the witnesses, associates of the patient, and his superiors should be questioned. The medical officer should not be emotionally influenced in his evaluation. The disposition of the patient is determined by the underlying mental or personality condition rather than by the severity or nature of the suicidal attempt or gesture. The physician is primarily responsible for the fates of the patient only when the patient is psychotic, has an obsessive-compulsive neurosis, a neurotic depression, or is mentally defective. It is the medical officer's responsibility to return all other patients, without exception, to their organization with recommendations for administrative or disciplinary action.

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be able to use both hands for the attachment of the syringe and for the injection. If an assistant is present, much time can be saved by having him attach the syringe to the needle, and perform the injection because he can keep both hands sterile throughout the entire procedure. From 1 to 2 cc. of the contrast medium is injected through the 26-gage needle and the patient is asked to describe any sensations he may have. Leading questions are avoided. The contrast medium is observed fluoroscopically and if found to be adequately visualized, a lateral radiograph is made using a stationary grid. This may be done either before or after the withdrawal of the needles. Then with the needles withdrawn, anteroposterior and oblique radiographs are made with a spot film device. The prone position facilitates the turning of the patient for oblique views. The procedure is repeated for the other 2 lower lumbar disks if desired. We usually inject all 3 lower lumbar disks, even if the symptoms suggest a lumbosacral lesion.

The amount of contrast medium injected is determined by the ease with which it flows into the disk, the reaction of the patient, the amount of pressure required to make the injection, and the degree of visualization as determined by fluoroscopy. Normal disks take 1 cc. or less with moderate pressure used during injection, although it is possible by using great pressure to inject as much as 2 cc. into a normal disk. The solution can be injected more readily into degenerated and ruptured disks and they require more solution for adequate visualization because it spreads readily throughout the areas of degenerated annulus and into any rupture that may be present. During the injection the pain experienced by the patient who has a herniated nucleus pulposus, is usually moderate to severe. Occasionally, it may be extremely severe, and in such patients the injection is temporarily stopped and then recommenced very slowly until visualization of the contrast medium is adequate.

I have injected 30 disks, of which 8 were believed to have herniations discographically. One of the 8 was believed to be a recurrent herniation following an operation for removal of a herniated disk, and a reoperation was not performed. The other 7 were operated on and a degeneration of the annulus with herniation was found in all. One patient had a ruptured disk which was found at operation, but not diagnosed by discography. Although the preliminary measurement in this patient showed that a 4-inch, 26-gage needle was required to reach the center of the disk, a 3½-inch needle was used. The injection of the contrast medium produced no symptoms, and although 2 cc. was injected, visualization was poor. The radiographs showed that most of the medium was in the epidural space, and the diagnosis was indefinite. This strengthens the belief that the injection should be into the center of the disk.



appended to each chapter. Ease of reading and comprehension is facilitated by the use of boldface type for biologic concepts, fundamental descriptive terms, and key cultural reactions of organisms, while experimental data of a highly technical nature are denoted by small type. Infectious organisms are discussed from the standpoint, among others, of historical review, morphology and cultural behavior, identification, susceptibility to physical and chemical disinfection, mode of transmission, vectors, the clinical picture of their respective diseases, treatment, and prevention. Special attention has been given to the effect of the newer antibiotics on each organism.

An outstanding contribution to the text is the very complete discussion of the nature of viruses as a group, their physical and chemical properties, and methods of cultivation, purification, and titration. The laboratory technician will welcome the improved section on technical methods, with its complete array of standard biochemical tests, chick embryo culture methods, and serologic and immunologic technics; an extensive reference table on examination of specimens from patients and cadavers, listing suspected organisms, specific culture media and isolation technics, is included. The scope, completeness, and effectiveness of the material make this text an invaluable aid to the student of pathogenic microbiology, the clinical practitioner, and the public health worker.—*Capt. F. L. Davis, U. S. A. F. (MSC)*

*Progress in Neurology and Psychiatry, Volume VII, An Annual Review, edited by E. A. Spiegel, M. D., Professor and Head of the Department of Experimental Neurology, Temple University School of Medicine, Philadelphia, Pa. 604 pages. Grune & Stratton, Inc., New York, N. Y., publishers, 1952. Price \$10.*

This book is a compilation of reports on recent psychiatric literature by 75 contributors. About 3,200 articles are cited as bibliographic references. The book is divided into sections on basic sciences, neurology, neurosurgery, and psychiatry. In view of the amount of material covered, it is remarkably complete and detailed and serves its purpose as a review. The section on basic sciences devotes much space to neurophysiology and pharmacology and presents these difficult subjects with unusual clarity. The section on neurology includes a new chapter on pediatric neurology. Otherwise it is similar to that in previous volumes. The neurosurgical section is the shortest but compares well with the others as a report of conclusions without detailed discussions of technics and experiments. The section on psychiatry is by far the longest section but successfully avoids verbosity. The book is well organized and indexed and will serve excellently as a reference when a brief review is desired.

—*Commander W. R. Griswold, MC, U. S. N.*

# DOUBLE V VENTRAL SLIT CIRCUMCISION

J. HARWEDA WOOLFOLK, *Captain, U. S. A. F. R. (MC)* (1)

DAN HUEBERT, *Captain, U. S. A. F. R. (MC)* (2)

**B**ECAUSE of the large number of military personnel who need or desire circumcision, a surgical procedure which would produce less pain postoperatively, reduce time lost from duty, and give a good cosmetic result was developed. Circumcision is indicated in adults for (1) phimosis; (2) paraphimosis with or without venereal and nonvenereal warts and ulcerated urens; (3) irritation resulting from the use of condoms and pressure of the prepuce during coitus; and (4) for cosmetic purpose. The two standard surgical procedures for circumcision are the dorsal slit and the guillotine technic. This report describes a new procedure, called the ventral slit, double V technic.

First the foreskin is retracted and double V incisions are made with a No. 15 scalpel blade. The distal V is made on the mucosa with the vertex beginning 2.5 cm. proximal to the coronae and continuing distally on either side to a point 1 cm. from the coronae. The two ends of the V are joined by a circular transverse incision extending around the penis (fig. 1). The proximal V incision is made in a similar manner, except that the vertex of the V is made from 1.5 to 2 cm. proximal to the mucocutaneous junction and continued distally on either side to a point 0.5 to 1.5 cm. from this junction. The two ends of the V incision are connected in a similar manner as the first V (fig. 1). The vertices of the double V incisions are then joined by a vertical incision (fig. 2). The mucosa and the skin are dissected along the line of incision. Using sharp, curved scissors, careful dissection is necessary to prevent cutting of blood vessels under the subcutaneous tissue. It is important to dissect as closely as possible to the tissue being removed.

The proximal V is included in the dissected flap, but the distal V is left to be approximated in the space where the second V is absent. This tissue is left on the ventral surface to protect the

(1) U. S. Air Force Hospital, Bergstrom Air Force Base, Austin, Tex.

(2) U. S. Air Force Hospital, Rapid City Air Force Base, Teaver, S. Dak.

since his release from the service, his symptoms have decreased. These cases suggest that the physical rigors of military service (long marches, calisthenics, et cetera) may put unusual stress on the tensor fasciae latae and hence be one of the precipitating causes of this illness.

Toxins, metabolic disorders, and infections were so rare in Ecker and Holtzman's series that they believed these played no appreciable part in the cause of the disease in their patients. Other authors (10, 11) listed such things as alcohol, morphine, lead, diabetes, gout, herpes zoster, typhoid fever, grippe, rheumatic fever, and syphilis (independent of a localized gumma) as possible causes.

### SIGNS AND SYMPTOMS

If a rigid definition is used for this disease there should only be a sensory defect over the distribution of the lateral femoral cutaneous nerve. In our series the distribution was usually oval in shape and the involvement was unilaterel. Not infrequently the sensory disturbance starts in a small area in the lower lateral aspect of the thigh and progressively becomes larger. The signs are limited to a hypalgesia, hypoesthesia, and hypothermia over part or the entire distribution of the nerve. The patients usually complain of numbness or burning. Most of our patients complained of "pins and needles," burning, or shooting pains over the distribution of the nerve when they stood for any length of time or walked for a long distance. These difficulties were most bothersome when the soldier had to stand at attention at parade, or in some even if it was only as long as standing for retreat. Marching the length of a parade ground was sufficient to produce paresthesias in several patients, though others noted their symptoms only if required to hike several miles. Roth (12) reported a 10-year-old girl whose pain was made worse when she lay down.

The motivation of the soldier is important in evaluating the disability produced by this illness. One officer had sharp, shooting pains whether at rest or in motion and was unable to continue his work which was limited to light duty in an office. When he was offered surgical treatment with the assurance of relief and return to full duty, he refused. On the other hand, a well-motivated officer from a combat unit, whose meralgia paresthetica followed a fracture of the pelvis due to a parachute jump, could not be adequately followed because he placed so little emphasis on his symptoms even though he presented the typical findings of this disease the one time he was seen. This difficulty in evaluating the disability produced by this illness is not limited to the military service but is also seen in civilian practice (11).

(11) Huddleston, J. H.: Meralgia paresthetica. Am. J. M. Sc. 175: 823-831, June 1923.

(12) Roth, P. B.: Meralgia paresthetica. Brit. M. J. 2: 536, Nov. 1916.

## TREATMENT

Most of the patients in our series were inadequately treated by explaining to them the nature of the illness and its limited symptomatology. This latter factor is particularly important for many of our patients were more impressed with the progressive character of the illness than with the symptoms themselves. Not infrequently it was necessary to excuse the soldier from long marches or prolonged standing. Three patients were given 120 micrograms of vitamin B<sub>12</sub> intramuscularly each day for 3 weeks. This was

based on the empiric use of this drug in other neuritides with reported good results (13, 14). In our hands, this therapy was useless. One patient, who had developed his symptoms shortly after coming into the service, who had an adequate military record despite his meralgia paresthetica, and who was to be discharged from the Army in several months, had symptoms severe enough to warrant surgical resection of the lateral femoral cutaneous nerve. He was followed for only a short time, but when last seen he found the anesthesia following operation not very bothersome and the relief from the sharp pains most gratifying. The consensus of others (10, 15) is that if the symptoms are severe, resection of the nerve is the treatment of choice. This is a relatively simple operation because of the superficial location of the nerve as it emerges beneath the inguinal ligament. The nerve can usually be easily blocked with procaine and hence a trial of this before resection is indicated so that the patient can judge whether he prefers paresthesias or analgesia. This can also be used as a prognostic guide to the efficacy of the surgical treatment. Heat, rest, and a reducing diet have been advised. Treatment of any underlying cause is of the utmost importance.

## PROGNOSIS

We have not had the opportunity to follow any of the patients in our series for a sufficient time to reach any conclusions about their ultimate fate. The longest duration of symptoms in a patient when first seen in this clinic was 10 years; the shortest was a few weeks; the mode was about 1 year. In Eckert and Woltman's series the duration of symptoms ranged from 35 years to less than 1 month. They concluded that "when the symptoms have lasted less than 2 years, the chances are 2 to 1 that they will disappear spontaneously within another 2 years."

(13) Fields, W. S., and Hoff, H. E.: Relief of pain in trigeminal neuralgia by crystalline vitamin B<sub>12</sub>. *Neurology* 2: 131-139, Mar.-Apr. 1952.

(14) Use of vitamin B<sub>12</sub> in neurology. (*Foreign Letters, Paris*) *J. A. M. A.* 148: 667, Feb. 23, 1952.

(15) Brais, W. R.: *Diseases of the Nervous System*. Oxford Medical Publications. 3rd edition, Oxford University Press, New York, N. Y., 1947.

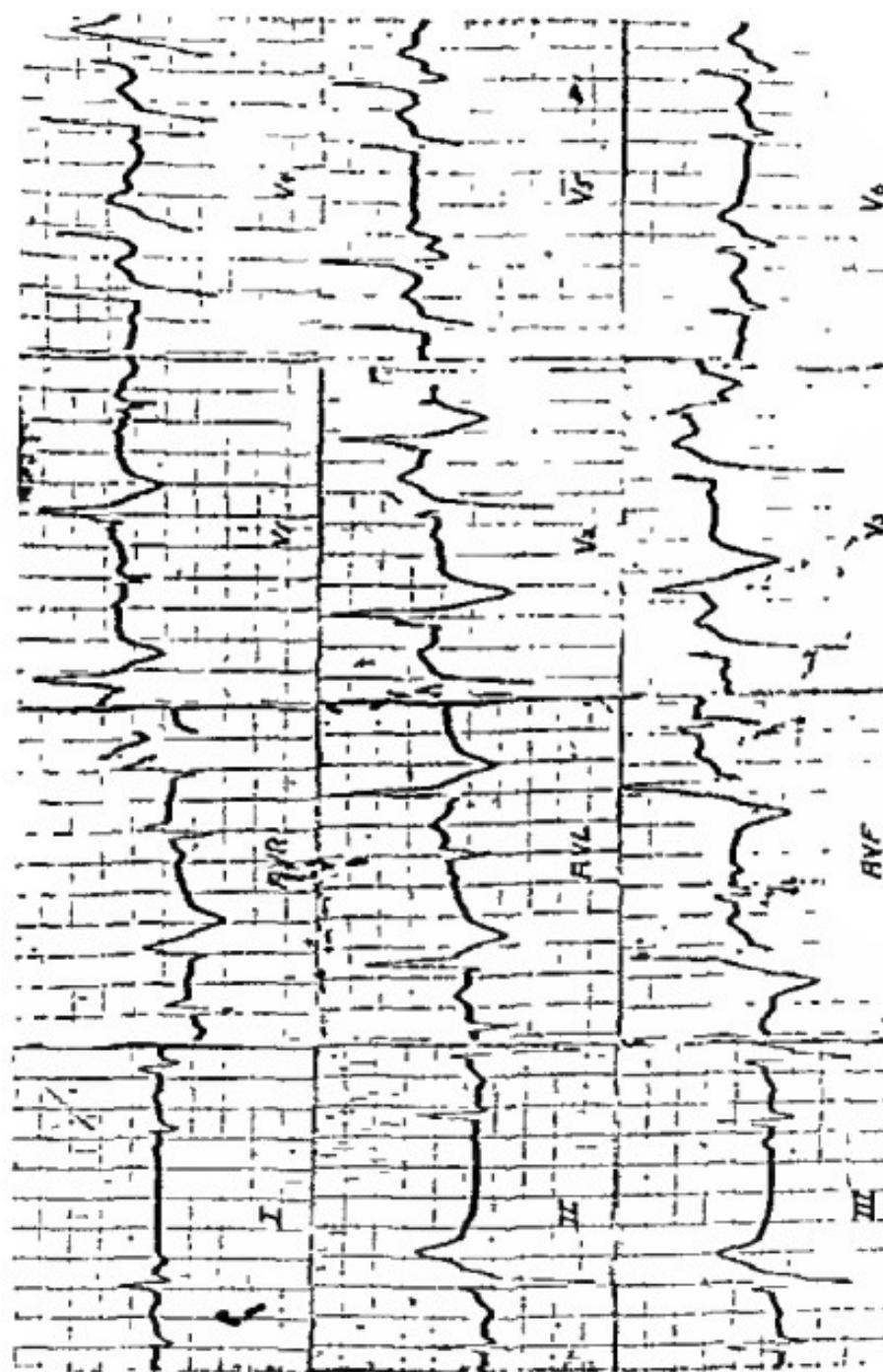
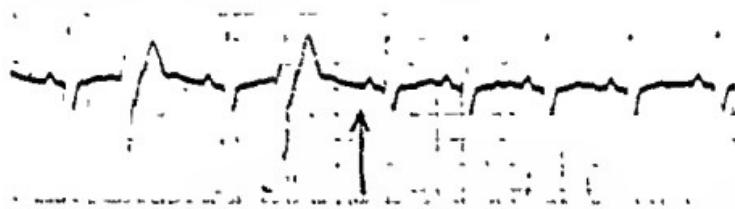


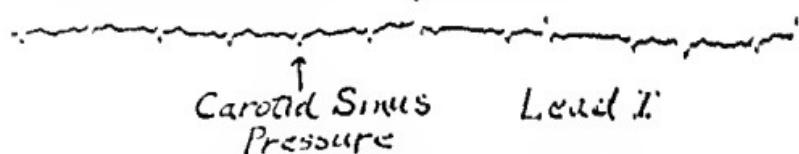
Figure 2. Tracings show bigeminal rhythm in all leads following the patient's assumption of the recumbent position.

regular sinus rhythm while the patient was sitting upright. Figure 2 shows development of bigeminal rhythm with the ectopic focus arising from the left ventricle when he assumed the recumbent position. This arrhythmia was reproduced in this patient whenever he assumed this position. It persisted for 5 minutes or longer than the rhythm would revert spontaneously to regular sinus rhythm (fig. 3). Vagotonic influences were responsible for



*Figure 3. Lead II tracing showing reversion of bigeminal rhythm to regular sinus rhythm after 5 minutes of recumbency.*

the development of premature ventricular contractions and bigeminal rhythm as shown in figure 4. The arrhythmia was reproduced by pressure on the carotid sinus after the patient developed regular sinus rhythm following prolonged recumbency. This observation was substantiated when the patient was given 1.2 mg. of atropine subcutaneously and allowed to assume the recumbent position. While under the effect of atropine he failed to develop bigeminy, even after carotid sinus pressure but as the effect of the atropine wore off in about 45 minutes it was again possible to induce premature ventricular contractions and bigeminy. This demonstrates the predominant role of vagotonic influences in the development of bigeminal rhythm in this patient.



*Figure 4. Tracing showing bigeminy following carotid sinus stimulation.*

The inversion of the T waves in leads II, III, and aVF (fig. 1) when the patient was in the upright position were probably due to sympathetic tone (8). This again demonstrates the autonomic nervous system imbalance present in this patient.

#### DISCUSSION

Although much experimental and clinical study has been accomplished, there is only scant knowledge regarding the normal regulation of the heart. We have learned that cardiac behavior is

communicable diseases and covers causal organisms, disease control (which includes carriers, relative legislation, government and private agencies in public health), immunity, and the numerous other introductory factors relative to communicable diseases. The excellent and interesting discussion on antibiotics can be easily understood by students. The presentation of nursing technics is clear, concise, unbiased, and includes disinfection, sterilization, prophylactic and miscellaneous technics employed in homes and hospitals.

Part I is a basic, essential preliminary to Part II which is an alphabetical arrangement of the communicable diseases. Each disease is thoroughly covered by definition, history, occurrence, and medical aspect (etiology, source of infection, route of transfer, incubation period, period of communicability, laboratory diagnosis, clinical picture, prognosis, complications and sequela, treatment, measures of control, nursing aspect, and special isolation and disinfection recommendations). To facilitate notations relative to new discoveries, reports, et cetera, blank pages have been inserted following the discussion of each disease.

Supplementary materials (Part IV) are covered in 5 sections and are useful in both teaching and learning. The section on disinfection procedures (a supplement to chapters in Part I) includes methods and materials to be used on various articles. For the teacher, as well as for the avid student, there is a list of general references, audio-visual aids, and situation questions.

As a whole, the charts, graphs, and photographs are excellent. There are a few, however, which this reviewer considers undesirable. Figures 40-44 and 54-57 show the use of long-sleeved gowns. It is the opinion of this reviewer, as a result of experience, that it is practically

without contaminating the ins . . . . . those that have snug-fitting c . . . . .

undesirable are figures 44 and 50 showing scrub sinks that are of the operating room type, a style with a breadth that invites contamination by body contact with the outer edge of the sink. Sinks used in isolation units should be of such design that it would not be impossible to keep from touching the sink while scrubbing. Figures 39 and 47 show the desirable style. This, however, is a minor criticism of an excellent textbook for teaching and one that every nurse, particularly if engaged in medical or communicable-disease nursing, would find to be a handy reference book.—*Lt. Comdr. G. E. Dvorak, NC, U. S. N.*

# TRAUMATIC ANEURYSM OF THE INNOMINATE ARTERY<sup>(1)</sup>

EVERETT H. DICKINSON, *Captain, MC, U. S. N.*

R. MAURICE HOOD, *Lieutenant, MC, U. S. N.*

FRANK C. SPENCER, *Lieutenant, junior grade, MC, U. S. N. R.*

**I**NJURIES to the innominate artery and other great vessels of the mediastinum are not infrequent. The majority of persons so injured die immediately or within a few minutes from exsanguination or pressure phenomenon. A review of the available literature reveals that ligation of the innominate artery is an infrequently performed procedure. Lindskog (2) stated that 107 ligations of the innominate artery had been reported. Of these, 75 were performed for spontaneous aneurysms, 11 for recent injuries of the innominate artery or one of its branches, and 1 for control of remote hemorrhage. Twenty ligations were performed for traumatic aneurysm of the innominate artery or one of its branches. Twelve of these involved the subclavian; 5, the innominate; and 3, the carotid artery.

Shumacker (3) reported that ligations for traumatic aneurysm of the innominate artery had been attempted on 37 patients of whom 19 survived. Rundlo (4) reported the first successful triple ligation and also a successful triple ligation with excision of the aneurysmal sac. Langley (5) reported a patient who had a through-and-through bullet perforation of the bifurcation of his innominate artery, in whom bleeding had spontaneously ceased, probably as a result of shock. He was explored a few hours after injury because of the appearance of signs of cerebral damage from carotid occlusion. He died a few hours after the operation, probably because of carotid ligation. Brock (6) reported an unfortunate example of failure to open the aneurysmal sac. His

(1) U. S. Naval Hospital, Oakland, Calif.

(2) Lindskog, G. E.: Surgery of innominate artery. *New England J. Med.* 233: 71-76, J. ly 18, 1946.

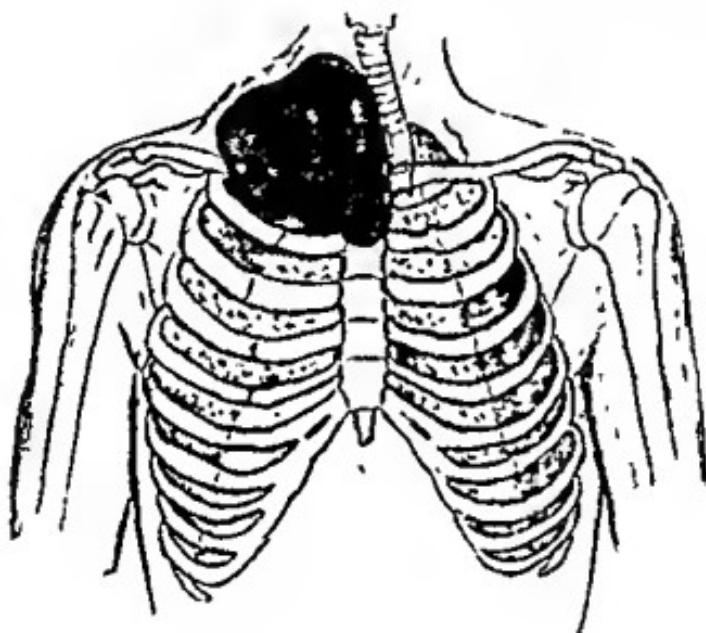
(3) Shumacker, H. B., Jr.: Surgical cure of innominate aneurysm report of case with comments on applicability of surgical measures. *Surgery* 22: 729-739, Nov. 1947.

(4) Rundlo, F.: Aneurysm of innominate artery treated by surgical report of a case and records of 22 cases collected from literature. *Britis. J. Surg.* 25: 172-190, July 1937.

(5) Langley, G. F.: Gunshot wound of innominate artery. *Britis. M. J.* 21: 711-712, Dec. 4, 1943.

(6) Brock, R. C.: Aneurysm of innominate artery report of case treated surgically. *Guy's Hosp. Rep.* 90: 180-195, 1940-1941.

The lower end of the skin incision was then extended laterally over the right third interspace. The pleural cavity was entered through the third interspace and the first 4 costal cartilages were severed near the sternum. About 1,000 cc. of blood were evacuated from the pleural space. The mediastinal pleura was intact, but the aneurysmal mass filled the superior



*Figure 2. Drawing showing the relative size of the aneurysm and the tracheal deviation.*

mediastinum and protruded into the apex of the pleural space for about 5 cm. The mediastinum was entered and the superior vena cava retracted anteriorly in an attempt to isolate the innominate artery at its origin from the aortic arch. Dense fibrosis from shell fragments prevented separation of the mediastinal structures, although the arch of the aorta could be palpated.

The vessels were partially compressed digitally at the aortic arch and the sternum was split with the Lehsche sternum shears to the third interspace and transected into the right third interspace. As the split sternum was retracted, severe arterial hemorrhage again occurred. This was controlled with difficulty by packing. At this point the patient had an estimated blood loss of 5,000 or 6,000 cc. Blood was being given under pressure in 1 arm and 2 leg veins; 6,000 cc. of blood had been infused, and the patient's general condition remained good.

The major difficulty was the inability to isolate the innominate artery proximal to the point of injury. The left third interspace

was opened and the left pleural space was entered, but the innominate artery could not be isolated. The only remaining possibility was to open the aneurysm directly and secure the bleeding points. With the vessels at the aortic arch partially compressed digitally, the aneurysm was widely opened. About 900 cc. of old clotted blood were evacuated in the presence of extremely severe arteriole hemorrhage and the innominate artery was secured by digital compression. From 1,500 to 2,000 cc. of additional blood loss were sustained before the artery was secured.

The subclavian artery had been completely transected just distal to its origin, the open end of the vessel being clearly visible in the base of the wound. An extensive rent was also present in the common carotid artery at its origin (fig. 4). The common carotid, subclavians, and innominate arteries were doubly ligated individually with No. 20 cotton sutures. The right subclavian and internal jugular veins had been injured and were



*Figure 3. Drawing showing topographic anatomy of the chest and the extent of the excision.*

also ligated (fig. 5). The exact nature of the injuries to the veins could not be clearly ascertained. The hematoma was evacuated of as much old blood as possible, leaving a cavity which had an approximate volume of 500 cc. in the superior mediastinum and base of the neck. The chest wall was reconstructed with sutures of No. 33 steel wire. The remainder of the wound was closed with interrupted No. 20 and No. 40 cotton sutures. Intercostal tubes were left in the third interspace in the anterior axillary line and in the ninth interspace in the posterior axillary line. A Penrose drain was placed in the hematoma. A tracheotomy was performed at the termination of the procedure.

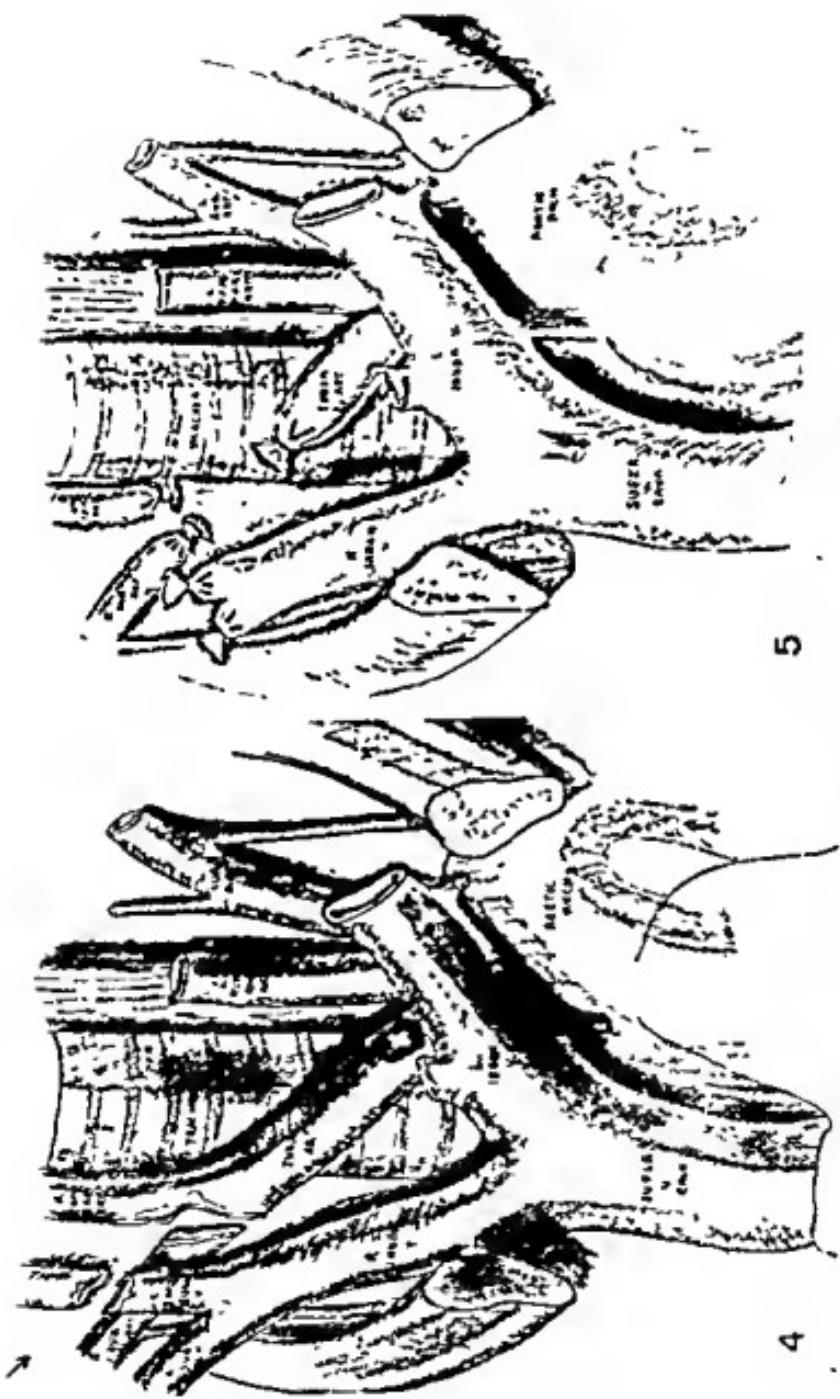


Figure 4, Drawing of the muscular anatomy showing the extent of the vascular injury at the bifurcation of the innominate artery and to the right internal jugular vein. The pathway (arrow) and final resting place (A) of the shell fragment are shown. Figure 5, Drawing showing the suture performed in correcting the muscular defect.

The patient's general condition remained surprisingly good throughout the operation, which lasted 6 hours. A total of 11,500 cc. of blood was given. The patient's blood type was AB, and only through the resourcefulness of the blood bank personnel was the patient's survival possible. At the end of the operation his entire right upper extremity was cool and cyanotic. The upper skin flap in his right third interspace had a similar appearance at the time of closure. His condition was otherwise satisfactory.

Postoperatively, he showed no sign of cerebral damage. His right arm became moderately swollen and was treated by elevation, elastic bandages, alcohol given intravenously, and intramuscular injections of papaverine. The coldness and cyanosis of his hand apparently originated from venous stasis as a result of ligating the subclavian vein. All symptoms had subsided by the fifth postoperative day. No arterial pulsation was palpable in his arm but his skin remained warm and of good color. He became moderately jaundiced by the second postoperative day, probably as a result of a mild hemolytic reaction from multiple transfusions totaling 11,500 cc. His urinary output was satisfactory, and the jaundice slowly subsided.

The skin incision over his sternum partially separated with the subsequent drainage of large amounts of purulent material, exposing the underlying third costal cartilage. There was no evidence of secondary hemorrhage from the ligated vessels. His chest wall rapidly became rigid. The exposed cartilage was excised on the twenty-first postoperative day, after which the wound rapidly healed. The tracheotomy tube was removed on the tenth postoperative day. The patient had a mild, persistent hoarseness although his vocal cords appeared normal. The Harner's syndrome on his right side persisted. At the time of his transfer to a hospital near his home on 21 December there had been no return of nerve function in his right upper extremity although there was no evidence of vascular insufficiency.

#### DISCUSSION

Traumatic injuries of large intrathoracic vessels are rarely seen because they are rapidly fatal. The reported survivors had only small wounds of entry which prevented rapid exanguination. The presence of a small skin wound, however, does not rule out a serious vascular injury.

This case illustrates the pressure effects of an expanding aneurysm on adjacent nerves. Although the brachial plexus had been paralyzed for only 2 weeks, the injury was complete. In the 2-month period during which he was under our observation there was no evidence of nerve regeneration. Proliferation

There is no single area in the brain where the duality of the stimulation is registered; and, indeed, the author describes the testings as revealing (1) lesions in the thalamus, internal capsule, parietal lobe, temporal lobe, and occipital lobe, (2) diffuse brain disease, and (3) degenerative diseases involving the corpus callosum. He also points out that this type of testing has been of value in delimiting the level of a spinal cord lesion.

A chapter is devoted to the various factors which may influence the patient's response to simultaneous stimuli such as (1) intensity of the stimulus, (2) the constant predominance of sensation in the face over more caudad sensations, and (3) the influence of background—both the environmental and the patient's own intrinsically organized pattern of reaction.

This book is recommended to neurologists and neurosurgeons. The portion devoted to early identification of certain hemianopias should be of value to the ophthalmologist.

—*Lt. Comdr. G. Clark, MC, U. S. N.*

*Pictorial Handbook of Fracture Treatment*, by *Eduard L. Compere, M. D., F. A. C. S.*, Associate Professor of Surgery, Northwestern University Medical School; Chairman, Departments of Orthopedic Surgery, Wesley Memorial and Children's Memorial Hospitals; Consultant in Orthopedics, Chicago Memorial and Lichtenstein Hospitals; Medical Adviser and Director, Rehabilitation Center of the Liberty Mutual Insurance Company, Chicago, and *Sam W. Banks, M. D., F. A. C. S.*, Associate Professor of Surgery, Northwestern University Medical School; Attending Orthopedic Surgeon, Chicago Memorial, Woodlawn and Hines Veterans Hospitals, Chicago. Revised with the assistance of *Clinton L. Compere, M. D., F. A. C. S.*, Assistant Professor of Surgery, Northwestern University Medical School; Attending Orthopedic Surgeon, Wesley Memorial Hospital; Consultant in Orthopedic Surgery, Augustana Hospital, Senior Consultant, Veterans Administration, Chicago. 424 pages; illustrated. The Year Book Publishers, Inc., Chicago, Ill., 1952. Price \$6.50.

This is a concise, lucid, and precise treatise dealing with the most recent and finest methods and procedures in the treatment of fractures. As an example of the excellent directives in treatment the following is quoted from the chapter on the hand: "Every injured finger should be immobilized until torn structures have had time to repair (and) the fracture has healed \* \* \*. Immobilization should be restricted to the injured finger or fingers with the joint kept in flexion whenever possible. Active exercise of the uninjured fingers is imperative." The step-by-step outline in technic of internal fixation or the closed reduction of fractures correlated with descriptive drawings, roentgenograms, and diagrams make this an invaluable book for the medical officer and an indispensable aid for the general practitioner, resident, intern, and medical student.

—*Capt. J. L. Schwartz, MC, U. S. N. (Ret.)*

# CARCINOMA OF THE LIVER WITH BONE METASTASES RESEMBLING MULTIPLE MYELOMA

JOHN C. BATES, Major, MC, U. S. A. (1)

**P**RIMARY carcinoma of the liver is relatively rare. Charache (2), in a survey of the records of 31 institutions, found 808 (0.5 percent) instances of primary carcinoma of the liver in 159,762 autopsies. Hoyno and Kornohan (3) found 0.227 percent in European and American peoples and a slightly higher incidence in Asiatics. Other authors give similar low percentages.

In Charache's study he added to his own 808 instances, 317 from the literature, making a total of 1,125. He reported only 18 instances of skeletal metastasis. Willis (4), in describing 16 patients with carcinoma of the liver, reported 2 with metastasis to bone. Spatt and Grayzel (5) reported 17 patients with carcinoma of the liver of whom 22 percent showed skeletal metastasis. Mallory (6), discussing a patient with bone involvement, commented that carcinoma of the liver is one of the types of carcinoma that metastasizes with great regularity to bone. These reports occur in the literature after the study made by Charache. It is suggested that skeletal metastasis may occur more frequently than Charache indicated and that the finding of such metastasis may be accounted for by (1) the heightened awareness of the possibility of skeletal metastasis in this disease and (2) the increasing use of roentgenographic examination in diagnosis.

Carcinoma of the liver is difficult to diagnose clinically and most cases are diagnosed either very late or at autopsy. It is not surprising then that a skeletal or other type of metastasis may be the presenting finding. Willis pointed out "that skeletal or other metastasis may clinically simulate primary disease or be the first

(1) Gorgas Hospital, Ancon, C. Z.

(2) Charache, H.: Primary carcinoma of liver report of case and review of literature. Am. J. Surg. 43: 96-105, Jan. 1939.

(3) Hoyno, R. M., and Kornohan, J. W.: Primary carcinoma of liver: study of 41 cases. Arch. Int. Med. 79: 532-554, May 1947.

(4) Willis, R. A.: Pathology of Tumours. C. V. Mosby Co., St. Louis, Mo., 1938, pp. 430-437.

(5) Spatt, S. D., and Grayzel, D. M.: Primary carcinoma of liver. Am. J. Med. 5: 510-573, Oct. 1948.

(6) Mallory, T. B.: Case Records of Massachusetts General Hospital. New England J. Med. 210: 133-135, 1939.

sign of illness\* as in his paraplegic patient who had bony metastasis. Moon's (7) patient presented himself with a pathologic fracture of a femur. Bolker et al. (8) also reported a patient with a pathologic fracture of the left femur as the initial complaint. Mallory's patient had few clinical findings in addition to an area thought to be a metastasis in the ulna. The patient reported here also shows the diagnostic difficulties because osseous metastasis at first clouded the diagnosis.

### CASE REPORT

A 44-year-old Panamanian was admitted on 15 May 1950 complaining of pain in the left side of his chest of 6 weeks' duration. The pain had gradually become more severe and was aggravated by deep breathing and by assuming certain positions. The patient thought he had had a fever on several occasions, but was vague as to the specific time of day it occurred or its duration. There were no night sweats or cough, but he thought he had lost some weight.

The patient appeared to be chronically ill. There was a questionable pleural friction rub over the base of his left lung. His hemoglobin was 12.24; his erythrocyte count was 3,680,000; and his leukocyte count was 4,600 with 62 percent neutrophils, 33 percent lymphocytes, 3 percent eosinophils, and 2 percent basophils. These hematologic findings are considered average for native Panamanians. His sedimentation rate was 33. A roentgenogram of the chest revealed a pleural reaction in the left base with associated blunting of the left costophrenic sulcus. Multiple circumscribed areas of rarefaction were present in the lower ribs bilaterally (fig. 1). Roentgenograms of the skull revealed multiple punched-out areas of rarefaction. There was destruction of both the inner and outer tables of the skull and there was no reaction about these areas (figs. 2 and 3). A tentative diagnosis of multiple myeloma was made on the basis of these findings.

Fourteen subsequent blood studies showed findings essentially the same as those reported. Six examinations for Bence-Jones proteins in the urine were negative. The total serum protein on 18 May was 6.14 mg. per 100 cc.; on 20 May it was 8.83 mg. per 100 cc. (albumin 3.70 and globulin 5.13); on 16 June it was 8.98 mg. per 100 cc. (albumin 3.60 and globulin 5.38). Acid phosphatase was 2.5 King-Armstrong units and alkaline phosphatase was 26.6 units. Sternal marrow examination showed no evidence to confirm the diagnosis of multiple myeloma.

(7) Moon, V. H. Primary carcinoma of liver with metastasis to bone. Arch. Path. 2: 938-943, Dec. 1929.

(8) Bolker, H., Jacobs, M., and Koven, M. T. Primary carcinoma of liver with bone metastasis. Ann. Int. Med. 10: 1212-1221, Feb. 1937.

The patient was presented to the tumor board, and here grave doubt was cast on the diagnosis of multiple myeloma. Further marrow studies and a biopsy of a rib were recommended. The patient refused these procedures. Because of a current interest in urethane, the patient was given a course of this drug. He improved



Figure 1.

clinically and became very eager to return to work. A definite diagnosis could not be made and because of the patient's marked clinical improvement he was discharged on 30 June with the advice to return periodically to the outpatient clinic for observation.

He was readmitted on 9 August complaining of nausea and vomiting of 24 hours' duration. He stated that the vomitus was streaked with bright red blood. He had no abdominal pain and up to the time of admission had not had any bleed in the stool. He thought that he had been having some fever and increased fatigability for about 3 weeks. He appeared to be emaciated. His



Figure 3.



Figure 2.

abdomen appeared to be somewhat distended. His liver was palpable 6 cm. below the costal margin and had a round nontender edge. There was no rigidity of the abdominal wall. The only palpable mass in his abdomen was his spleen which was felt at the level of the umbilicus and was nontender. There was moderate generalized enlargement of his lymph nodes. His hemoglobin was 11.5; his erythrocyte count was 3,150,000; his leukocyte count was 6,600 with 76 percent neutrophils, 4 percent eosinophils, and 20 percent lymphocytes. Gallbladder visualization was attempted, but the dye failed to concentrate in the gallbladder. A roentgenogram of the chest showed no change in the lesions of the ribs but the pleural reaction had cleared.

The patient's abdomen became more distended and he began to complain of pain in the right upper abdominal quadrant. A paralytic ileus developed which was relieved by a Wangensteen suction apparatus. Ascites developed after the ileus had receded. A paracentesis was performed and 1,900 cc. of a yellow, cloudy fluid was removed. An iliac marrow study was made and was reported as essentially normal. During the late phase of the illness the leukocyte count went up to 14,000 with an increase in the polymorphonucleocytes. The patient gradually became worse and on 7 September a yellow tint was noted in his scleras. Within 2 days this became an obvious jaundice. The icteric index rose to 67. The van den Bergh reaction was 4 plus. The quantitative bilirubin was 8.2. The cephalin-cholesterol flocculation test was 4 plus. At one time during this phase there was a strong suggestion of a palpable gallbladder. Ascites continued and frequent paracentesis was necessary. He died on 22 September.

The final clinical diagnosis was carcinoma of the gallbladder or liver. Autopsy revealed an adenocarcinoma of the liver, biliary-duct type with metastases in the lungs, adrenals, regional lymph nodes, pituitary, and bones (skull and ribs).

#### SUMMARY

This case is presented because the metastases to the skull and ribs resembled the lesions seen in multiple myeloma. None of the other cases that were reviewed showed these findings.

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EDITOR'S NOTE: A paper entitled "Primary malignant disease of the liver" by C. H. Sanford, appears on pp. 304-312 of the August 1952 issue of the Annals of Internal Medicine.

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## BOOK REVIEW

The Treatment of Injuries to the Nervous System, by Donald Munro, M. D., F. A. C. S., Surgeon-in-Chief, Department of Neurosurgery, Boston City Hospital; Associate Professor of Neurosurgery, Boston University School of Medicine, Assistant Professor of Neurosurgery, Harvard University Medical School. 284 pages, illustrated. W. B. Saunders Co., Philadelphia, Pa., publisher, 1952.

The author draws on his extensive clinical experiences in traumatic neurosurgery at the Boston City Hospital to combine in this compact, readable text both a philosophy of treatment and a practical guide to definitive treatment of the various injuries to the central and, to a lesser extent, the peripheral nervous system. Perhaps justifiably, because this volume is directed primarily to the general practitioner, the approach is quite dogmatic but, as the author states, the method has the virtues of practicality, the authority of evolutionary development over a period of years, and the honesty which is inherent in a constant checking of mistakes by the house staff and by postmortem examinations made by or under the direction of a medical examiner. The approach emphasized in this manual can best be summarized by quoting: "Even these attributes (enthusiasm, patience, attention to minutiae of therapy) are useless unless this surgeon is also convinced that no matter how extensive the paralysis \* \* \* (the patient) ambulation with infallible 24-hour control of bladder and bowel \* \* \* is well within the possibility of present-day treatment."

The general care of the patient from the time of injury, including transportation, necessary definitive operation, and rehabilitation in the convalescent stage, is emphasized throughout the manual. Equipment and technic are outlined for everything from a spinal tap to such craniocerebral operations as subtemporal decompression. There is a stimulating chapter on the cost of medical care in paraplegia and how it may be modified by rehabilitation services based on data acquired by a large insurance carrier of workmen's compensation liability. The last two chapters emphasize the psychology of rehabilitation and the important part played by the hospital personnel, from the trustees down, and the appropriate attitude to be fostered in the patient.—*Lt. Comdr. R. G. Berry, MC, U. S. N.*

# COMPLICATIONS OF MUMPS

HARRIS D. RILEY, JR., *Captain, U. S. A. F. (MC)* (1)

**A**LTHOUGH usually considered a disease of childhood, many nonimmune adults contract mumps and in a high percent of patients it is followed by disabling complications. The incidence of mumps among military personnel is relatively high. Parran (2) stated that "next to the venereal diseases, mumps is the most disabling of the acute infections among troops." Wesselhoeft (3, 4) reported that 3,884,147 man-days were lost in World War I because of mumps. The fact that complications of mumps are much more common in adults than in children is important in military medicine.

## CASE REPORTS

*Case 1. Mumps with orchitis.* A 22-year-old man was admitted to this hospital on 21 December 1951 with slight pain at the angle of both jaws of 4 hours' duration. He had never had mumps and there was no known exposure. Physical examination revealed a slight swelling at the angle of both jaws, and prominent posterior cervical nodes bilaterally. There was no redness or swelling of the orifices of Stenson's duct. The genitalia were normal. On the third day the patient developed tenderness and pain of both testes with low grade fever. This was treated supportively and subsided in 4 days. The patient was discharged on the seventeenth day.

*Case 2. Mumps with pancreatitis.* A 23-year-old airman was admitted to this hospital on 9 January 1952 because of swelling at the angle of the right jaw of 24 hours' duration. Another airman living in the same barracks had been hospitalized 2 weeks previously with mumps. This patient had never had mumps. There was marked swelling of both parotid glands with edema and redness of the orifices of Stenson's duct. The parotid swelling gradually subsided but on the seventh day the patient developed nausea without vomiting, cramping pain in the right upper abdominal quadrant and epigastrium, and a temperature of 104° F. There was slight tenderness in the right upper abdominal quadrant but no spasm. Serum amylase drawn at this time was reported as 229 units

(1) U. S. Air Force Hospital, Stewart Air Force Base, Tenn.

(2) Parran, T.: *Health and medical preparedness*. J. A. M. A. 115: 49-51, July 6, 1940.

(3) Wesselhoeft, C.: *Mumps: Its Glandular and Neurological Manifestations*. Virus and Rickettsial Diseases. Harvard University Press, Cambridge, Mass., 1940. p. 309.

(4) Wesselhoeft, C.: *Medical progress: mumps*. New England J. Med. 226: 530-534, Mar. 26, 1942.

per 100 cc. This patient was treated expectantly with analgesics and fluids parenterally. In 3 days he was afebrile and asymptomatic. He was discharged on the thirteenth hospital day.

*Case 3. Mastitis following mumps.* A 9-year-old girl was seen in the pediatric clinic of this hospital because of tenderness and swelling of both breasts. About 2 weeks previously she had developed bilateral parotid swelling following intimate exposure to a playmate with mumps. The swelling had lasted 1 week. Five days after it subsided she developed pain and tenderness, followed by slight swelling, of both breasts. There was no history of any predisposing cause of mastitis, and she had not had mastitis or mumps in the past. There was no parotid swelling and positive physical findings were limited to the breasts, which were exquisitely tender, slightly warm, and swollen. The changes were more marked on the left side. The breasts were covered with loose fitting sterile gauze and the patient was given analgesics as necessary. In 4 days all signs of inflammation had completely disappeared.

*Case 4. Mumps meningo-encephalitis.* A 20-year-old man was admitted to this hospital on 12 January 1952 because of headache. One week previously he had developed parotid swelling and pain which had gradually subsided in 5 or 6 days. He stated that he had had an "enlarged head" as long as he could remember. Two years previously, following a dental extraction, he had developed a left hemiparesis which had persisted. He had not had mumps. Physical examination on admission revealed a small, thin, young man who had an obviously enlarged head which measured 65 cm. in circumference. He refused to walk and complained of headache. A slight residual parotid swelling was present. There was no papilledema but there was evidence of a right facial nerve palsy. The neck was moderately rigid but Kernig's and Brudzinski's signs were negative. There was a residual left spastic hemiparesis. Lumbar puncture revealed slightly increased pressure, 14 mononuclear cells per cc., a positive Pandy's test, and a total protein of 213 mg. per 100 cc. Roentgenograms of the skull revealed hydrocephalic changes with flattening of the sella turcica but no erosion. Following the lumbar puncture the patient felt better and there was gradual disappearance of the nuchal rigidity and headache. A lumbar puncture, 9 days later, revealed only 3 cells and a decrease in the protein to 50 mg. per 100 cc. I believe that this patient had mumps meningo-encephalitis superimposed on a pre-existing neurologic disease. Because this patient was a member of another service he was transferred to an Army hospital for investigation of his long-standing difficulties after treatment of his acute process.

*Case 5. Recurrent mumps.* A 25-year-old man was admitted to this hospital on 22 October 1951 because of pain in the right side of his neck and left side of his face of 2 days' duration. Soon after the onset of pain, swelling developed in his left parotid and right submaxillary areas. He had had mumps in 1946 and in 1950. Communication with the physician who treated him in 1950 confirmed the diagnosis. Physical examination revealed swelling of the left parotid and right submandibular salivary glands. The patient was afebrile. During his course in the hospital, with general supportive measures, the swelling of the affected glands gradually subsided and he was discharged on the tenth hospital day.

TABLE 1. Incidence of mumps complications in the Willard Parker Hospital, New York, N. Y., from 1929 to 1932

	Number of patients
Hospitalized with mumps	252
Oorchitis	27
Pancreatitis	13
Meningo-encephalitis	2
Thyroiditis	1

### DISCUSSION

The incidence of complications of mumps in the U. S. Army in World War II was 25 percent (5). Table 1 gives the analysis of the various complications as observed in a civilian communicable disease institution (6). *Oorchitis* occurs in about 1 percent of children with mumps but in adults the incidence has been variably reported as from 10 to 50 percent (average 18 percent). The onset usually occurs between the fifth and tenth day after the swelling of the affected testis, and is accompanied by general malaise and discomfort in the inguinal region. The swelling progresses for 2 or 3 days and then regresses, usually returning to normal in from 7 to 10 days, but the course may be more severe. The testis is usually more severely affected than the epididymis. Occasionally, orchitis may be the only manifestation of mumps. Atrophy of the testis is common but impotence and sterility are rare.

*Meningo-encephalitis* is much more common in children but does occur in adults. Some investigators believe that a spinal fluid

(5) Stokes, J., Jr.: Mumps (epidemic parotitis). In Nelson, W. E. (editor): Mitchell-Nelson Textbook of Pediatrics, 5th edition. Philadelphia, Pa., 1950. pp. 620-624.  
 (6) Eagles, A. Y.: Analysis of 4 year epidemic of mumps. Arch. Int. Med. 80: 374-387, Sept. 1947.

pleocytosis occurs in all patients with mumps whether signs of meningo-encephalitis are clinically present or not. In a series of 40 patients, routine examination of the cerebrospinal fluid revealed 16 with definite pleocytosis. In 6 of these there were no clinical signs of involvement of the nervous system (7). Meningo-encephalitis may occur prior to, during, or following the phase of salivary gland swelling, although most cases appear from 3 to 10 days after the onset of the parotitis.

*Pancreatitis* is a comparatively rare complication of mumps. Radin (8) reported that out of almost 6,000 cases of mumps in military personnel, 14 patients had symptoms referable to pancreatitis. It occurs in both sexes and may be transient, mild, or severe. The onset is usually between the fifth and eleventh days with nausea, anorexia, and a high fever which returns to normal in from 3 to 5 days. Vomiting may or may not occur. Pain in the upper abdomen is usually intense (most frequently in the left upper quadrant) and is accompanied by tenderness. Constipation is the rule. Oophoritis in female and occasionally prostatitis in male patients may have to be ruled out (9). Sailer (10) found jaundice in 4 out of 13 patients with this type of pancreatitis. High serum amylase values may be expected during the active stage of mumps and whenever there is obstruction to the normal flow of secretion from diastase-producing glands, particularly the parotid and pancreas (11). The demonstration of a normal value of serum amylase in a patient with facial swelling is good evidence against mumps because 95 percent of patients with mumps have an elevated serum amylase (12). Acute pancreatitis also produces elevation of the serum amylase. In pancreatitis due to mumps the serum amylase elevation is greater than the average expected levels of those in uncomplicated parotitis (11, 12). The serum lipase is usually elevated in mumps pancreatitis and this may be helpful in making the diagnosis although clinical evidence is the best means of diagnosis (13). The prognosis of this complication is good but the patient may be extremely ill during the course. There are only 2 reported deaths attributed to pancreatitis in which autopsy findings are given (9).

(7) Finkelstein, H. (Teas Orange, N. J.) Meningo-encephalitis in mumps. *J. A. M. A.* 111: 17-19, July 2, 1938.

(8) Radin, M. J. Epidemic of mumps at Camp Wheeler. *Arch. Int. Med.* 22: 354-369, Sept. 1918.

(9) Brahy, M. B., and Scheffer, L. H. Pancreatitis complicating mumps. *Am. J. U. S.* 18: 255-260, Feb. 1931.

(10) Sailer, J.: Mumps. *M. Clin. North America* 3: 1423-1435, Mar. 1920.

(11) Zelman, S. Blood diastase values in mumps and mumps pancreatitis. *Am. J. U. S.* 20: 461-464, Apr. 1944.

(12) Applebaum, L. L.: Serum amylase in mumps. *Ann. Int. Med.* 21: 35-43, July 1944.

(13) Candel, S., and Theelock, W. C.: Serum amylase and serum lipase in mumps. *Ann. Int. Med.* 25: 88-96, July 1946.

*Mastitis* is a rare complication of mumps. It is characterized by pain, tenderness, and swelling of one or both mammary glands and may occur at any time after the appearance of the parotitis, although it is seen most commonly after the parotid swelling has started to subside. Mastitis may occur in either sex. The prognosis is good and clearing is usually complete.

The protection offered by an attack of mumps is usually lasting. However, there are interesting reports describing relapses and recurrences. A French soldier was reported to have suffered 6 attacks over a 3-year period, each attack corresponding to a separate exposure. In certain instances wind instrument players have experienced relapses and recurrences. Contrary to a popular notion, immunity following unilateral mumps is just as durable as when the swelling is bilateral (14). Eagles (6) reported that 30 of 439 patients in an epidemic at Ft. Benning, Ga., gave a history of previous infection. Royce (15) presented evidence that recurrent swelling of the parotid gland may occur on an allergic basis. This may have been the cause in the patient here reported but as the serologic studies for mumps were incomplete and the patient is no longer at this installation, it is impossible to reach a definite conclusion.

The complications described are those most frequently associated with mumps but there are several others less commonly encountered. Oophoritis is said to occur in 5 percent of all women with mumps but is not as serious as orchitis in men because the ovary has no inelastic covering such as the tunica albuginea of the testis. Prostatitis, vulvovaginitis, dacryoadenitis, thyroiditis, myocarditis, pericarditis, and presternal edema have been reported. Deafness, labyrinthitis, facial nerve palsies, and optic neuritis may also occur but are extremely rare. Edema of the pharynx and larynx may occasionally necessitate tracheotomy (3, 5, 14). Some workers have speculated on the possibility of the development of diabetes mellitus after mumps.

(14) Bradford, W. L.: Mumps (epidemic parotitis). In McQuarrie, I. (editor). Brenneman's Practice of Pediatrics. Vol. 2. W. F. Prior Co., Inc., Hagerstown, Md., 1949. pp. 1-9.

(15) Royce, S. W.: Recurrent swelling of parotid glands. Paper presented before meeting of American Pediatric Society at Old Point Comfort, Va., May 7, 1952.

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